The JOURNAL OF RESEARCH IN INDIAN MEDICINE

Vol. IV, No. 2 1970
भाग ४, अंक २ १९७०

COMPLIMENTARY COPY

आयुर्वेद-अनुसंधान पत्रिका

Published by
POST GRADUATE INSTITUTE OF INDIAN MEDICINE
BANARAS HINDU UNIVERSITY, VARANASI
FOR
CENTRAL COUNCIL OF AYURVEDIC RESEARCH,
GOVERNMENT OF INDIA

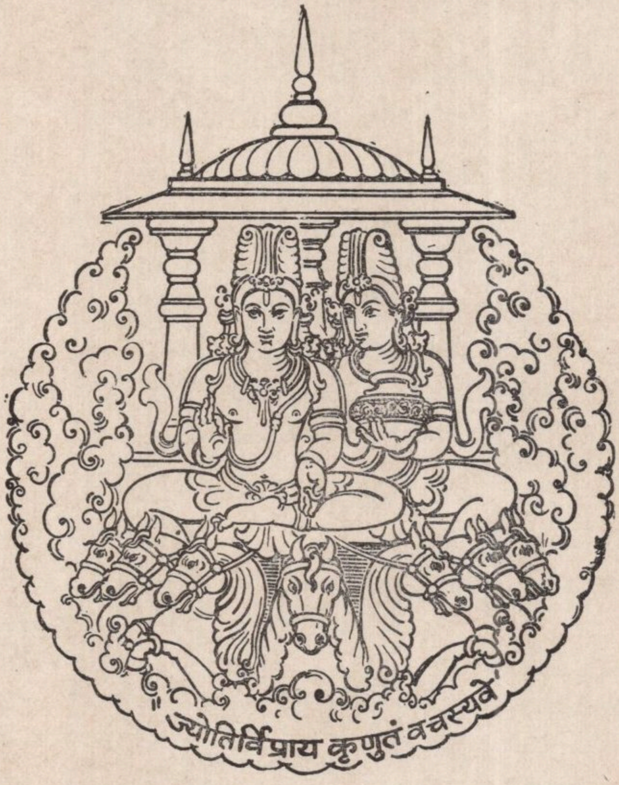
AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Vol. IV, No. 2
भाग ४, अंक २

1970
१९७०

The JOURNAL OF RESEARCH IN INDIAN MEDICINE

आयुर्वेद-अनुसंधान पत्रिका



Published by
POST GRADUATE INSTITUTE OF INDIAN MEDICINE
BANARAS HINDU UNIVERSITY, VARANASI
FOR
CENTRAL COUNCIL OF AYURVEDIC RESEARCH,
GOVERNMENT OF INDIA

EDITORIAL AND BUSINESS OFFICE: THE JOURNAL OF RESEARCH IN INDIAN MEDICINE,
POST GRADUATE INSTITUTE OF INDIAN MEDICINE,
BANARAS HINDU UNIVERSITY, VARANASI-5, INDIA.

Annual Subscription : In India Rs. 12.00; U. S. A. $ 2.00 ; U. K. 15 Sh.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Journal of Research in
INDIAN MEDICINE

Vol. IV, No. 2, 1970.

Patrons

Shri K. K. SHAH (New Delhi)
Shri S. CHANDRASEKHAR (New Delhi)
Shri B. S. MURTY (New Delhi)

Chief Editor

K. N. UDUPA (Varanasi)

Honorary Editors

G. N. CHATURVEDI (Varanasi)
P. S. SANKARAN (Varanasi)

EDITORIAL BOARD

Chairman

Col. R. N. CHOPRA (Srinagar)

Vice-Chairmen

P. N. V. KURUP (New Delhi)
C. DWARAKANATH (New Delhi)
P. V. SHARMA (Varanasi)

MEMBERS

N. R. Apte (Poona)
R. B. Arora (New Delhi)
L. S. Bhatnagar (Raipur)
M. L. Dhar (Lucknow)
V. N. Dwivedi (Varanasi)
P. K. Das (Varanasi)
P. J. Deshpande (Varanasi)
D. S. Gaur (Varanasi)
B. B. Gaitonde (Bombay)
G. K. Karandikar (Aurangabad)
P. M. Mehta (Bombay)
B. Mukherji (Calcutta)
A. N. Namjoshi (Bombay)
K. K. Parameshwaran Pillai (Trivandrum)
G. S. Pendse (Poona)
S. Prasad (Varanasi)
S. Rangaswami (Delhi)
T. R. Seshadri (New Delhi)
Col. B. L. Taneja (New Delhi)
S. N. Tripathi (Varanasi)
Y. N. Upadhyaya (Varanasi)
Bapalal G. Vaidya (Surat)
M. V. Venkataraghavan (Madras)

Editorial Secretary

V. N. PANDEY (Varanasi)

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Journal of Research in
INDIAN MEDICINE

Vol. IV No. 2, 1970.

CONTENTS

	Page
Editorial	i-iv
Prasad, G. C., Chatterji, S. C. and Udupa, K. N. Effect of phytogenic steriod of Cissus quadrangularis (*Hadjora*) on endocrine glands after fracture (*with 8 figures in text*).	132
Tewari, P. V., Chaturvedi, C. and Dixit, S. N. Anti-fertility effect of betal leaf stalk (*Tambul Patrabrint*). (*with 7 figures in text*).	143
Bhattacharya, S. K., Lal, R., Sanyal, A. K., Das Gupta, B. and Das, P. K. Pharmacological investigation on the total tertiary alkaloids of Fumaria parviflora Lam (*Parpataka*). (*with 5 figures in text*).	152
Ramaswamy, A. S., Periyasamy, S. M. and Basu, N. Pharmacological studies on Centella asiatica Linn. (*Brahma Manduki*) (N.O. Umbelliferae). (*with 13 figures in text*).	160
Bhattacharya, S. K., Lal, R., Basu, K. and Das, P. K. Pharmacol gical studies on the roots of Abroma augusta Linn. (*Ulatkambal*) (*with 5 figures in text*). ..	176
Garg, B. D., Gupta, S. K., Krishnaswamy, N. R. and Arora, R. B. Phytochemical and pharmacological investigations of Anchusa strigosa (*Gaozban*): An Indian Medicinal plant. (*with 2 figures in text*).	185
Ansari, M. S., and Prasad, S. Pharmacognostical studies on roots of Tribulus terrestris Linn. (*Gokhru Mool*) (*with 3 figures in text*).	193
Prasad, S., Shah, C. S., Shah, N. S., Ansari, M. S. and (Miss) Mitra, R. Pharmacognostic study of the leaves of Pluchea lanceolata C. B. Clarke and Olive. (*Rasna*) (*With 1 figure in text*).	203
Prasad, S. and Wahi, A. K. Pharmacognostical study of leaf of Vitex negundo Linn. (*Nirgundi*) (*with 2 figures in text*).	208
Sharma, B. M., Singh, P. and Atal, C. K. Pharmacognostic study of fruits of Mimusops elengi L. (*Bakul*). (*with 3 figures in text*).	214
Prasad, S. and Wahi, A. K. Pharmacognostical studies on Stephania glabra Miers. (*Rajpatha*). (*with 5 figures in text*).	221
Afaq, S. H. Botanical identity of Zarnab (Flacourtia jangomas Lour). (*with 5 figures in text*).	232
Short Research Communication	
Zalil, A. Clinical Trials of Ocimum sanctum (*Tulsi*) in peptic ulcer and hyperacidity patients	238
News Item	240
Government Notification	211
Cumulative Index	242

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4:2, 1970.

Editorial

MEDICAL ETHICS IN ANCIENT INDIA

Ever since our country awakened into independence more than two decades ago, there has been a renewed attempt to bring about an harmonious blending of two powerful cultures, namely of the east and the west. With the advancement of science, medicine too has made great strides. By following and imitating the west, our country can hardly keep pace with the rest of the world and hence, original contributions in science alone would be able to bring our country at par with others. Medicine is no exception. Therefore, the Government of India have been generously encouraging research in Indian Systems of Medicine, so that, India could make significant contribution in this field. Many research centres have been started and an intensive study of the ancient system of medicine is being carried out.

It is a well known fact that medical practice in India has been considered a respectable and noble profession from the very early days of history. That this discipline had occupied the curricula of the great Gurukulas-residential universities of *Takshashila*, *Kashi*, *Pataliputra* (*Nalanda*) is more than positive evidence to vindicate the above claim. The university education of Internal Medicine, Surgery and other branches of medical sciences has been the cause to impart dignity to the science and the profession. It was through this agency that the great schools of *Atreya*, *Dhanvantri* and later on *Vagbhata* came into vogue.

The Samhitas of the above personages therefore, not only contain the management of diseases and their prevention but also certain codes of conduct for the profession in general and medical man in particular. It will be of great interest to have a peep into these Samhitas in the context of the developing new facets of medicine, including medical education and social medicine.

Medical science deals chiefly with four important components, *i.e.* medical man, medical student, the patient, and the society. The society derives maximum benefit from a good medical man. Medical education plays an important role in the creation of ideal physicians and surgeons. Therefore,

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

great stress had been paid in the propagation of medical knowledge. This involves two important persons namely the teacher and the taught. The Samhitas ordain for proper selection of the students. They should possess sound qualities of both the body and the mind.

The preceptor should select as student, one who is young, who possesses good conduct, courage and cleanliness, strength of body and mind, intelligence, will power, memory, grasp and keen desire to learn and reach his ends in view. Combined with handsome physical features as thin tongue and lips, regular pointed teeth, well formed mouth, nose and eyes, he should have a cheerful spirit, pleasant expression, action and endurance[1].

The teacher should ask the student to get rid of lust, anger, greed, ignorance, haughtiness, roughness of behaviour, habit of carrying tales and telling lies, lethargy and other unwholsome habits. He should have clean shaved face and pared nails, should observe cleanliness and wear saffron clothings. He should speak truth and observe celibacy. With the permission of the teacher he should attend the other activities like going out, sleeping, eating and reading. He should do only that which his teacher likes[2]. An intelligent student aspiring to become a medical man should take every effort in developing all his faculties so that he may really prove 'the life-giver' of humanity[3]. The student should not confine himself to the study of a single branch of science because it does not lead to complete knowledge of the science. Therefore, a medical man ought to learn as many sister disciplines as necessary[4]. The subjects of other related sciences ought to be learnt from the lecturers of the specialists. Why ? It is impossible in a single science to include all other sister disciplines[5]. Once the student has learnt the entire science he should be initiated into practice. Methods of practical application of incision and other manoeuvres should be taught. Despite great learning an uninitiated medical man is not fit to start practice.[6] Before starting practice he should get the royal sanction.[7]

---

[1] Sus. Sut. 2-3.
[2] Sus. sut. 2-6.
[3] Car. sut. 1-133.
[4] Sus. sut. 4-7.
[5] Sus. sut. 4-6.
[6] Sus. sut. 9-3.
[7] Sus. sut. 10-3.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

In his practice, he should prove to be an ideal medical man. The life and happiness of the patients are in his hands. Therefore he should combine his learning with experience and use his judgement in every case he attends. For, it is said that success achieved without the exercise of the reason is indeed a chance.[1] Intelligent handling is more required since the patient who may suspect his relatives, his sons and even his parents, resigns his body himself unto the hands of his attending surgeon/physician on whom he reposes his entire confidence. Therefore, the medical man ought to take care of his patient as none but his own son.[2] His motto of profession should be to serve neither for gain nor gratification of senses, but he should be moved to practice by his natural feeling of compassion for the ailing. Then only he surpasses all other co-professionists.[3]

The profession becomes stagnant unless the medical man is engaged in his pursuit of study. He should be a student all his life, ever studying his own branch and reading relevent sister disciplines.[4] He should engage in healthy discussions of his subject and do his best for the propagation of knowledge through teaching and lectures. The study of medicine is deep as the ocean[5] and one can not realise all the hidden treasures by superficial probing. Therefore, one should incessantly work on enlarging one's knowledge by sincere and devoted application.

A medical student having finished the course of his study can do further research and add fineness to his practice. Cultivating the habit of good speech and constant practice in the art he has learnt, his unremitting efforts should be directed towards attainment of perfection.[6] He should be ever ready in facing the new challenges. In this new endeavour the young scientist has to work without haste and without rest. His results should not guide his research, nor should he claim false priority.

Open mindedness, clearity of thought, and quick grasp of knowledge coming from any quarter are[7] sure to maintain the springs of scientific

[1] Car. vim Sidhi. 2-28.

[2] Sus. sut. 25-43-44.

[3] Caɹ. Chik. 1-4-58.

[4] Car. vim. 4-5.

[5] Sus. U. Har. 19-17.

[6] Sus. sut. 3-56.

[7] Car. vim 14.-8,

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

advancement and allow the seeds of new medical knowledge to germinate. We are sure, if these seeds are scrupulously cared and nourished they will sprout out tender off shoots which ultimately grow into trees. These trees shall remain capable of emanating the fragrance which would fill the atmosphere far and wide.

In our rapid march forward we should not ignore our past. Winston Churchill once remarked "the longer you can look back, the farther you can look forward." Therefore, Indian Medicine is not only of antiquarian interest, contrarily it is capable of offering sound suggestions and possibilities for future.

P. S. SANKARAN,
Hony. Editor
&
V. N. PANDEY,
Editorial Secretary.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4 : 2, 1970.

THE EFFECT OF PHYTOGENIC STEROID OF CISSUS QUADRANGULARIS (HADJORA) ON ENDOCRINE GLANDS AFTER FRACTURE

G. C. PRASAD*, S. CHATTERJEE** AND K. N. UDUPA***

(From the Department of Shalya Shalakya, Post Graduate Institute of Indian Medicine and Surgical Research Laboratory, College of Medical Sciences, Banaras Hindu University, Varanasi—5).

(Received for publication on May 16, 1969)

Introduction

Effect of corticosteroid on the bone is well known for its inhibitory action on the proliferation of osteogenic cells and its constituents like mucopolysaccharide (Layton, 1951), collagen and minerals (Kowalewsky, 1962). Clein and Kowalewsky in 1962 have demonstrated on experimental animals that this action of cortisone can be neutralisd by using anabolic hormone i.e. Dianabol, particularly during fracture healing.

From our earlier studies on fracture healing, the influence of vitamins, hormones including under total alcoholic extract of '*Cissus quadrangularis*' (C.Q.) the latter showed its beneficial effect (Udupa and Prasad, 1965). Further, the above authors have isolated an active principle (Phytogenic steroid) from this drug and demonstrated its accelerating effect on the process of fracture healing in experimental animals (Udupa *et al.*, 1965). This phytogenic steroid was compared with a known anabolic hormone *i.e.* Dianabol and it was observed, that, its action was similar. In view of these findings, further studies on its effect on endocrine glands and the changes brought about during the process of bone repair have been carried out and reported in this paper.

Materials and Methods

In this experiment, one hundred and ninety albino rats of 80 to 90g weight and of same age and sex were selected for study. The right humerus of each animal was fractured as described by Udupa and Prasad in 1963. All the animals were divided in three groups. Group I having ninety animals as controls recieved distilled water intramuscularly; second group of animals were treated with Phytogenic steroid from *Cissus quadrangularis* (C.Q.) intramuscularly in dosage of 200µg per 100 g of body weight on alternate days. The third group of animals, ten in number, were kept as control in an unfractured state to find out the normal values. Ten animals from both the groups *i.e.* control and treated, were sacrificed by decapitation at different intervals from one hour to sixteen days. The endocrine glands namely pituitary, thyroid, adrenal and testes were dissected out and fresh wet weights were taken on a micro-analytical balance. Three glands from both the groups, control and treated, were fixed in special fixatives for histological and histochemical studies as indicated below: pituitary gland in Hely's fixation; adrenal gland in Zenker's fluid; thyroid and testes in Bouin's solution. They were then

*Lecturer **Senior Research Fellow. ***Professor.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

dehydrated in alcohol, embedded in paraffin and thin sections were cut at six microns. Pituitary gland sections were stained with Pearse trichrome method, adrenal gland with Geimsa stain, thyroid and testes with Delafield's Haematoxylin and Eosin stain.

EFFECT ON CASTRATED ANIMALS

In this group, forty young albino rats of same weight and age were selected for study. Both the testes of all the animals were taken out by operative method. Fifteen days following the day of castration, the right humerus of each animal was fractured as mentioned above. These animals were then divided into three groups : (*a*) control, containing twenty animals, (*b*) second group, containing ten animals treated with C.Q. steroid on every alternate days and (*c*) ten animals receiving Aquaviron (Indian Schering Co.) intramuscularly in the dose of 8 mg/100 g of body weight twice a week. Ten animals from the control group were sacrificed a week after fracture. All the remaining animals *i.e.* ten control group, ten C.Q.—treated, and ten animals Aquaviron-treated, were sacrificed at the end of second week after fracture.

Endocrine glands such as the pituitary, thyroid and adrenals of the experimental animals were removed and the fractured bones were then dissected out. After weighing the glands, these were fixed in different fixatives. The fractured bone was fixed in Acid Zenker. Paraffin sections were cut at six microns and stained as mentioned earlier. Fractured bone was stained with Toluidine blue, Vongeisson, P.A.S. and Haematoxylin and Eosin stains.

In addition to this, Capon's comb experiments were also performed. Here C.Q. steroid was administered intra-muscularly on every alternate day upto 16 days in the dose of 400 μg followed by Aquaviron in the dose of 16 mg.

BIOCHEMICAL ESTIMATION

Fractured bones of both the control and treated groups were dissected out after sacrificing the animals. The bones were dried in the oven till the weights became constant and then hydrolysed in 6 N. HCl. One millilitre of the aliquot was taken for the estimation of hexosamine by the method of Rondle and Morgan (1955) and hydroxyproline by Neuman and Logan (1950). Nitrogen was estimated by the micro-Kjeldahl method. The estimations of acid and alkaline phosphatase were done by the usual methods on frozen specimens of the endocrine glands.

Results

WEIGHTS OF THE ENDOCRINE GLANDS

Changes in the weights of the endocrine glands are shown in fig. 1. An increase is noticed in the pituitary weight half an hour after trauma which reaches maximum at two hours, followed by another increase at 24 hours after which it tends to come down to normal level gradually in the later period (Table 1). The increase in the weight of the thyroid gland (Fig.2) was maximum at the end of two hours followed by fall upto eight hours to rise again in the subsequent periods (Table 2). Similarly the weight of the adrenal gland as shown in Fig. 3 had greater increase immediately after fracture and reached maximum at four hours followed by another rise at 24 hours. On statistical analysis no significant differences were observed in the weight increase of pituitary (Table 1), thyroid (Table 2) and adrenal (Table 3) glands when compared with the control values. However, statistically significant weight increase could be recorded in the testes of the treated groups as compared with controls.

In treated animals, the maximum weight increase of the testes was seen at forty eight hours, when there was fall in the weight

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

of the pituitary gland. Animals treated with C.Q. steroid showed more increase in weight of the testes at the same period (Fig. 4). This observation was then compared with the effects

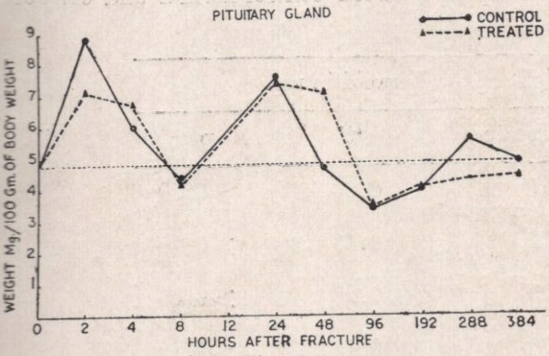


Fig. 1

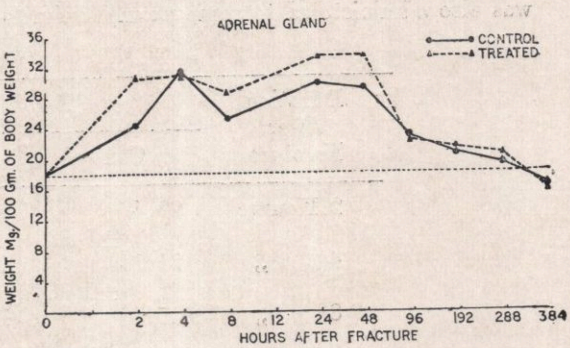


Fig 3

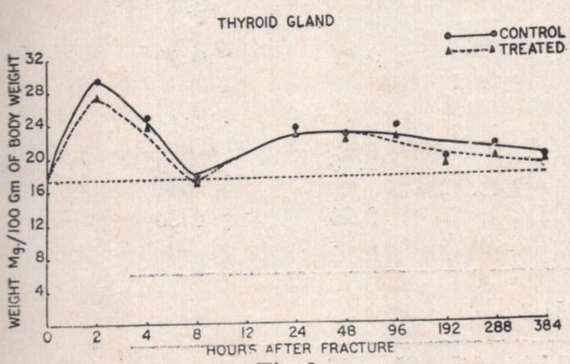


Fig 2

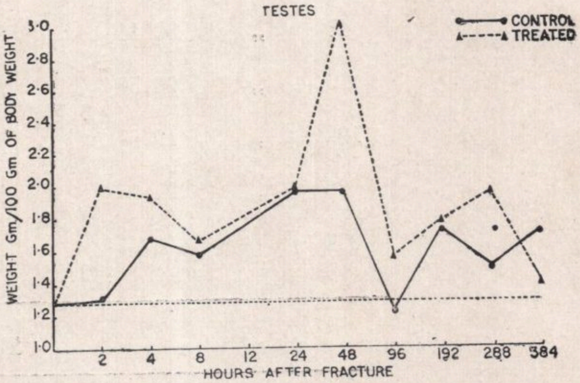


Fig 4

Table 1

Duration after Fracture	Total Weight of Pituitary in mg.			
	Control	Treated	't'	P
2 Hours	8.80 ±1.81	7.18 ±1.63	1.69	>0.10
4 ,,	6.01 ±1.34	6.69 ±1.07	1.05	>0.30
8 ,,	4.38 ±1.02	4.2 ±1.02	0.31	>0.70
24 ,,	7.5 ±1.93	7.43 ±1.13	0.08	>0.90
48 ,,	4.66 ±1.10	7.03 ±1.52	3.51	<0.01
96 ,,	3.4 ±1.07	3.87 ±1.38	0.69	>0.50
192 ,,	4.0 ±1.26	4.08 ±0.62	0.60	>0.50
288 ,,	5.52 ±0.71	4.33 ±0.70	2.93	<0.02
384 ,,	4.87 ±0.56	4.37 ±1.15	0.97	>0.30

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

following administration of a known anabolic hormone, 'Durabolin', The phytogenic steroid was also administered to some normal animals and its increase in weight of the testes was measured at the end of forty-eight hours to compare between control-normal and control-

Table 2

Duration After Fracture	Total Weight of the Thyroid in mg.			
	Control	Treated	't'	p
2 Hours	29.4 ±5.69	27.57 ±3.56	0.68	>0.50
4 ,,	24.84 ±5.98	23.71 ±4.36	0.43	>0.70
8 ,,	17.70 ±3.17	17.29 ±2.17	0.29	>0.80
24 ,,	23.43 ±5.32	22.50 ±3.24	0.42	>0.70
48 ,,	22.44 ±2.30	22.39 ±3.24	0.03	>0.90
96 ,,	23.57 ±3.11	22.24 ±2.92	0.87	>0.50
192 ,,	19.61 ±2.42	18.92 ±3.35	0.47	>0.70
288 ,,	21.0 ±3.50	19.09 ±3.55	1.06	>0.30
384 ,,	19.47 ±3.02	19.11 ±5.00	0.16	>0.80

Table 3

Duration After Fracture	Total Weight of the Adrenal in mg.			
	Control	Treated	't'	P
2 Hours	24.47 ±8.61	30.49 ±3.77	1.95	>0.05
4 ,,	31.77 ±5.72	31.23 ±5.93	0.20	>0.80
8 ,,	25.34 ±3.50	28.74 ±6.84	1.25	>0.20
24 ,,	30.02 ±6.28	33.38 ±6.47	1.12	>0.20
48 ,,	29.34 ±5.55	33.67 ±5.01	1.68	>0.10
96 ,,	22.99 ±5.95	22.49 ±4.10	0.18	>0.80
192 ,,	20.81 ±3.93	21.51 ±3.68	0.37	>0.60
288 ,,	19.61 ±2.07	20.73 ±4.04	0.65	>0.50
384 ,,	16.86 ±3.83	16.27 ±3.21	0.30	>0.70

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Table 4

Duration After Fracture	Total Weight of the Testes in mg. Control	Treated	't'	P
2 Hours	1.31 ±0.41	2.00 ±0.41	3.63	<0.01
4 ,,	1.68 ±0.24	1.93 ±0.63	0.94	>0.30
8 ,,	1.58 ±0.11	1.67 ±0.32	0.64	>0.50
24 ,,	1.96 ±0.20	1.98 ±0.20	0.12	>0.80
48 ,,	1.96 ±0.28	3.00 ±0.61	4.00	<0.001
96 ,,	1.22 ±0.34	1.55 ±0.24	1.91	>0.05
192 ,,	1.72 ±0.60	1.78 ±0.25	0.22	>0.70
288 ,,	1.48 ±0.11	1.94 ±0.16	5.74	<0.001
384 ,,	1.70 ±0.45	1.38 ±0.38	1.35	>0.20

fracture, C.Q. steroid in normal and C.Q. steroid in fracture and Durabolin treated animals (Fig. 5). The weight of the testes was more in C.Q. steroid treated animals than in the rest (Table 5).

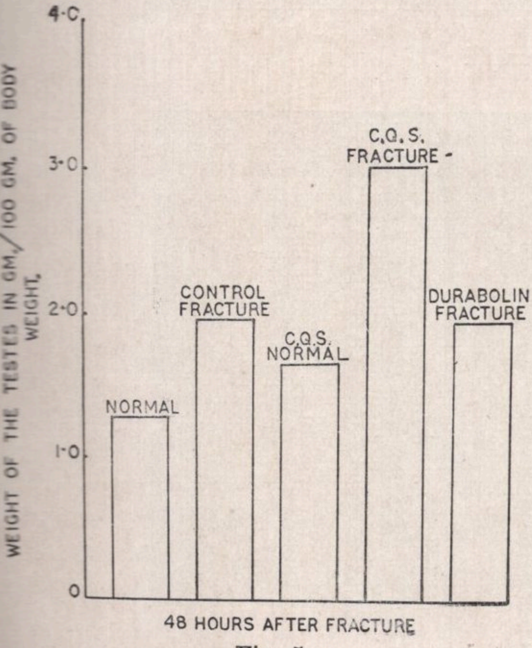


Fig. 5

Table 5

Series of Experiment	Total Weight of the Testes in mg. Mean	S.D.	't'	P
Normal	1.28	±0.25		
Control	1.96	±0.28		
C. Q. S.	3.0	±0.61		
Durabolin	1.93	±0.16		
C. Q. S. Normal Testes	1.65	±0.18		
Between Normal Control & Normal C.Q.S.			3.78	<0.01
Between Control & C.Q.S.			4.00	<0.001
Between Control & Durabolin			1.02	>0.30
Between Durabolin & C.Q.S.			3.69	0.01

HISTOLOGY AND HISTOCHEMISTRY

The cytological examination of pituitary showed more of basophilic cells, particularly, gonadotrophic cells and less of thyrotrophic cells in the early hours after fracture. As the interval is increased, the number of these cells diminished and thyrotrophic cells become more evident. Similarly, the histological changes in the thyroid gland showed increased cellular hyperplasia of follicular cells and decrease in the colloid matter

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

in the early hours. In the later period, the colloid matter reappears in the follicle. The increase in the weight of the adrenal glands, corroborated with the histological observation of increase in all the three zones of the adrenal cortex, particularly in the zona fasciculata and zona reticularis at the end of twenty four hours. Animals treated with the C.Q. steroid, histologically did not show much difference in these glands in comparison with control. The detailed histological investigation of the testes showed an increase in the intertubular spaces and thinning of the basement membrane forty-eight hours after fracture. Whereas the animals treated with this steroid, revealed a decrease in intertubular space with active spermatogenesis (Fig. 6).

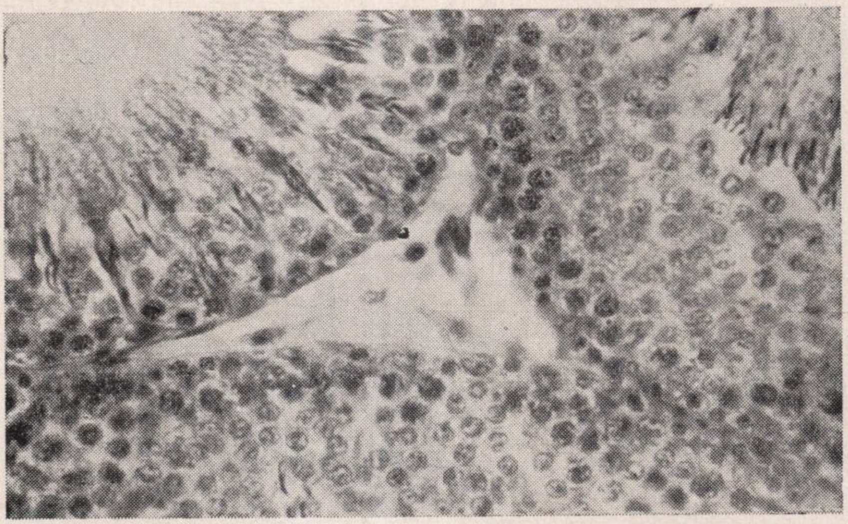


Fig. 6A Control

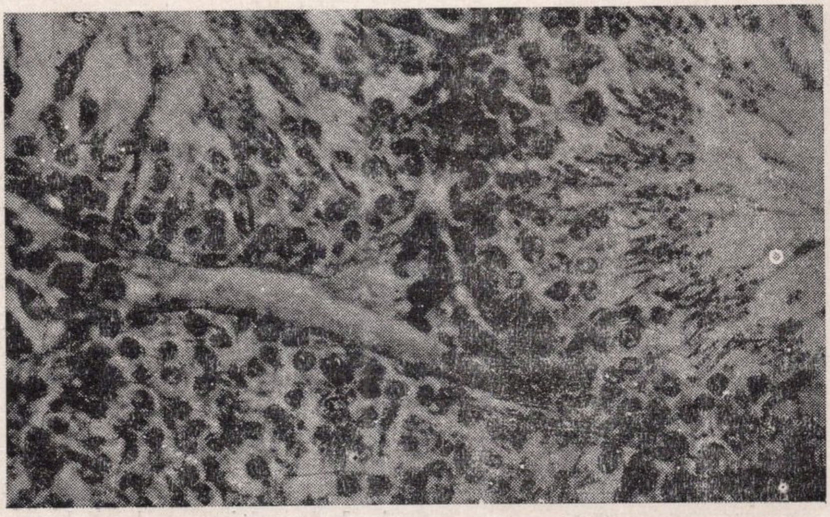


Fig. 6B Treated

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

As shown in Table 5, a statistically significant difference could be seen in the level of acid phosphatase at ½ an hour, two hours and 48 hours between control and treated. In control the level was 11.2, 29.6 and 58.0 Unit/100 mg respectively, whereas in treated it is raised to 29.0, 72.0 and 159.2 Unit/100 mg. Similarly the alkaline phosphatase level was increased throughout the period except at the end of four hours and eight days after fracture. The maximum increase in the alkaline phosphatase has been observed in the treated animals more than the control at the end of 48 hours (Fig. 7).

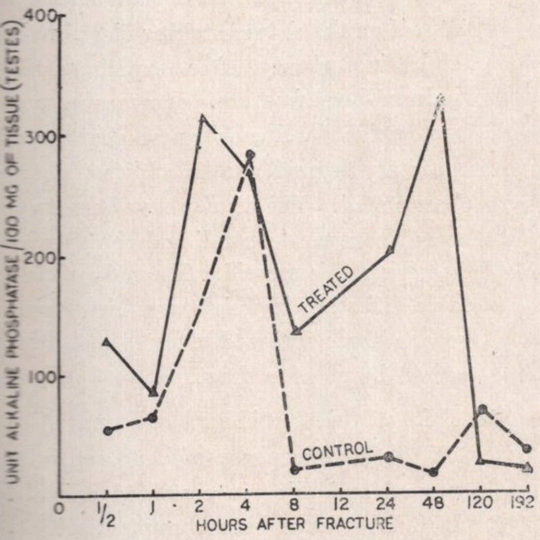


Fig. 7

PHASES OF FRACTURE HEALING

The histological (Toluidin blue, P.A.S. and Vongeisson staining) studies showed the appearance of acid mucopolysaccharide at the fracture site four to five days after fracture. The P.A.S. and Vongeisson stainings were positive from seven days onwards. Histological observations indicated that the entire gap was filled up with collagen fibres in the centre and enchondral ossification at the periphery. In castrated animals, the accumulation of acid mucopolysaccharide was delayed considerably in comparison with control. If at all present, a few cartilagenous patches are seen without much new bone formation at the end of fifteen days after fracture.

Among castrated animals, those which received Aquaviron showed new bone formation with enchondral ossification as it ocurs in control animals. Similarly, the animals which received injections of C.Q. steroid also showed enchondral ossification by the end of fifteen days after fracture.

Furthermore, C.Q. steroid did not show the sign of regeneration of the comb of castrated chick. If same chick received an injection of Aquaviron, a rapid reappearance of comb could be observed.

Discussion

The results clearly indicate that the total wet weights of the endocrine glands showed in general an increase. In case of the pituitay gland, this increase occurred within ½ an hour after producing fracture and reached its maximum in two hours. Then the weights gradually fell during the subsequent hours with another small rise at the end of twenty-four hours. These immediate changes in the pituitary gland suggests a possible neurogenic response, probably mediated through the hypothalamus. The cytological examination revealed more of basophilic cell, particularly gonadotrophic and less of thyrotrophic during early period. The animals treated with C.Q. steroid did not give positive weight increase response, possibly because it did not exert much influence on the pituitary response to fracture.

Similarly, the increase in the weights of the thyroid gland was noticed at the end of the second hour with another rise at the end of twenty-four hours after trauma. This increase in weight of

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

thyroid could be due to increased secretion of T.S.H. from pituitary. A parallel depletion of secretion could be noted in the thyrotrophic cells in the pituitary at this period. These observations appear to corraborate the findings of William, Jaffe and Kemp, (1949), and Soffer and Gabrilove (1951).

The weights of the adrenal glands were higher immediately after trauma and reached maximum at four hours followed by another rise at 24 hours. Histologically, adrenal gland showed hypertrophied cortical and medullary cells after trauma (Chatterjee, Prasad and Udupa under publication). There was not much difference in increase in the weight of thyroid and adrenal gland of control and the treated animals. Observations on I^{131} uptake of thyroid glands, carried out seperately in our laboratory also did not reveal any differences.

The only difference in the increase between control and treated in weight of these endocrine glands was noticed in case of testes, which is statistically highly significant. This increase in testicular weight suggests probably an increase in its androgenic activity.

To find out, whether C.Q. steroid acts as an androgenic hormone or as an anabolic hormone, Capon's comb tests were done which suggested that the C.Q. steroid did not possess any androgenic property. Therefore, its action may be assumed to be of anabolic nature, similar to the known anabolic hormone, Durabolin. In fact, the C.Q. steroid gave definite evidence of a more powerful anabolic function than Durabolin. The stimulation of the endochondral ossification in castrated animals lends further support to our observation. The values of the acid and alkaline phoshatase determinations in the testes were also highly significant. These evidences are strongly suggestive of the fact that the C.Q. steroid and Durabolin exert similar anabolic hormone functions.

Attempts to study this interesting similarity of action between a phytogenic steroid (C.Q. steroid) and the well known anabolic hormone Durabolin are being actively pursued in this laboratory through different modern techniques of electron microscopy and radioactive isotope labelling.

Summary

(1) Laboratory studies were undertaken to assess the effect of *Cissus quadrangularis steroid* on the changes taking place in the endocrine glands after experimentally induced bone fracture. Increase in total wet weight and cytological changes of pituitary thyroid, adrenal and testes have been noted. The results have been compared between 'control' and the animals receiving this steroid. The only noticeable difference in weight and histological changes was observed in testes at the end of 48 hours after fracture.

(2) Effect of this steroid has also been studied on the organic phase of bone repair in normal and also in castrated animals. Its effects have been compared with a known anabolic hormone (Durabolin) and the possibility of its action as an androgenic hormone was excluded through the use of the Capon's comb test which proved negative.

(3) Different biochemical estimations carried out on these glands, particularly testes of both treated and control animals, appear to support the contention that this hormonal steroid of vegetable origin has similar action to Durabolin, a known anabolic hormone. This opens out an

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

interesting possibility and points to a rationl way of explaining the bone-healing property of this reputed vegetable drug.

Further experiments are under way to clinch the issues which still remain open for conclusive and confirmatory evidence in this regard.

REFERENCES

CHATTERJEE, S., PRASAD, G. C. AND UDUPA, K. N. (1969) ... Changes in endocrine glands during fracture repair and effect of their ablation. (J. Trauma, Under publication.)

CLEIN, L. J., AND KOWALEWSKI, K. (1962) ... Some effects of cortisone and an anabolic steroid on healing. Canad. J. Surg. 5, 108.

GODE, J. D., PRASAD, G. C., SEN, S. P., AND UDUPA, K. N. (1966) ... The phytogenic anabolic steroid in the management of fracture cases. An Exp. & Clinical study. J. Ind. Med. Assos., 48, 9, 475.

KOWALEWSKI, K. (1962) ... Effect of steroid on bone formation in protein metabolism, influence of growth hormone, anabolic steroids and nutrition in health and disease. An International Symposium Sponsored by Ciba. Leyden, Jence. 25, 29.

LAYTON, L. L. (1951) ... Effect of cortisone upon chondroitin sulphate synthesis by animal tissue. Proc. Soc. Exp. Biol. Med. 76, 596.

NEUMAN, R. E. AND LOGAN, M. A. (1950) ... The determination of collagen and elastin in tissue. J. Biol. Chem. 186, 549.

PRASAD, G. C. AND UDUPA, K. N. (1963) ... Effect of Cissus quadrangularis on the healing of Cortisone treated fractures. Ind. J. Med. Res. 15, 4, 667.

PRASAD, G. C. AND UDUPA, K. N. (1970) ... Advances in Research in Indian Medicine 1st Ed. pp. 163—194. B.H.U. Press, Varanasi-5.

RONDLE, C.J.M. AND MORGAN, W.T.J. (1955)... The determination of glucosamine and galactosamine. Biochem. J. 61, 586.

SOFFER, L. J., GABRILOVE, J. L., DORRANCE, W. R. (1957) ... Effect of adrenocorticotropin on thyroidal collection of I^{-131} in the adrenalectomised and intact rats. Exp. Biol. Med. 76, 763.

[illegible], A. R. AND COFFER L. J. (1951) ... The influence of cortisone and adrenocorticotropin on Urinary gonadotropin excretion. J. Clin. Endocrinology. 11, 667.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

UDUPA, K. N. AND PRASAD, G. C. (1964) ... Further studies on the effect of Cissus quadrangularis in accelerating fracture healing. Ind. J. Med. Res. 52, 1, 26.

UDUPA, K. N. AND PRASAD, G. C. (1964) ... Biochemical and Calcium^{-45} studies on the effect of Cissus quadrangularis in fracture repair. Ind. J. Med. Res. 52, 5, 480.

UDUPA, K. N. AND PRASAD, G. C. (1962) ... Cissus quadrangularis in fracture repair "A clinical study." J. Ind. Med. Ass. 38, 11, 590.

UDUPA, K. N., PRASAD, G. C. AND SEN, S. P. ... (1965) The effect of phytogenic steroid in the acceleration of fracture repair, Life. Sc. 4, 317.

WILLIAM, R. H., JAFFE, H. AND KEMP. C. ... (1949) Effect of severe stress upon thyroid function. Am. J. Physiol. 159, 291.

हिन्दी सारांश

अस्थि भग्न के पश्चात् अन्तःस्रावी ग्रन्थियों पर पादप आनुवंशिक स्टीरायड का प्रभाव

गुरुचरण प्रसाद, एस० चटर्जी एवं के० एन० उडुप

(शल्य विभाग एवं शल्य अनुसंधान प्रयोगशाला, आयुर्विज्ञान महाविद्यालय, काशी हिन्दू विश्वविद्यालय, वाराणसी–५)

प्रस्तावना

अस्थिगत एवं अस्थि जनक कोशिकाओं के प्रगुणन तथा उनके अन्तर्निहित पदार्थ जैसे, म्यूकोपालीसेकाराइड, कोलेजेन तथा खनिज की मात्रा पर कार्टिकोस्टीरायड का ह्रासक प्रभाव (लेटान, १९५१, कोवलेवस्की, १९६२) देखा गया है। क्लीन और कोवलेवास्को ने १९६२ में अपने जैविक प्रयोगों से स्पष्ट कर दिया है कि एनाबोलिक हारमोन्स जैसे डाइनाबाल के द्वारा विशेष तौर से अस्थि भग्न को रोपण की स्थिति में कार्टीजोन के प्रभाव का प्रतिरोध किया जा सकता है।

अस्थिभग्न के रोपणार्थ बिटामिन, हारमोन तथा हड़जोड़ के संपूर्ण अल्कोहलीय सारतत्व के गुणकारी प्रभाव को उडुप तथा प्रसाद, (१९६५) ने इंगित किया था। हड़जोड़ से ही पादप आनुवंशिकी स्टीरायड प्राप्त कर प्रायोगिकी जीवों के अस्थि भग्न के रोपण में सद्यः प्रभावकर बताया गया है। इस स्टीरायड की प्रक्रिया का सापेक्ष अध्ययन डाइनबाल के साथ किया गया, जिसमें इसका गुण बराबर पाया गया। इन्हीं सब उपरोक्त तथ्यों को ध्यान में रख कर अध्ययन के विकास की एक कड़ी के रूप में इस औषधि का प्रभाव अन्तःस्रावी ग्रन्थियों पर विशेष तौर से अस्थि भग्न के रोपण पर देखा गया तथा उसे ही इस निबन्ध में प्रस्तुत किया गया है।

सामग्री और विधि

इस प्रयोग के लिए सामान्य प्रकार के ९० श्वेत चूहों को, जिनका शारीरिक भार ८० से ९० ग्राम के बीच में था, जो सामान आयु तथा लिंग के थे, लिया गया। हर चूहे की दाहिने ओर की ह्युमरस नाम की हड्डी उडुप और प्रसाद की (१९६३) वर्णित विधि के आधार पर तोड़ी गयी। इन जीवों को तीन भागों

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

में विभक्त किया गया। प्रथम भाग के जीवों को केवल बाष्पित जल, मांसपेशीगत अन्तःक्षेपण विधि द्वारा दिया गया। दूसरे वर्ग को 'पादप-आनुवंशिकी स्टीरायड' २०० माइकोग्राम प्रति १०० ग्राम शारीरिक भार की मात्रा में एक-एक दिन के अन्तर पर दिया गया। तीसरे वर्ग में १० चूहों को सामान्य नियंत्रित वर्ग के रूप में रखा गया।

शिरच्छेद-विधि द्वारा नियंत्रित और चिकित्सित वर्ग के चूहों को एक घन्टे से लेकर १६ दिन के बीच में समय समय पर मारा गया। उनके मारने के बाद सद्यः उनकी अन्तःस्रावी ग्रन्थियाँ, जैसे पियूष-ग्रन्थि, गल-ग्रन्थि, अधिवक्र-ग्रन्थि एवं वृषण ग्रन्थियों को शल्य क्रिया द्वारा अलग निकाल कर उनका भार सूक्ष्म विश्लेषणी तुला द्वारा मापा गया। तीनों वर्गों से प्राप्त चार प्रकार की ग्रन्थियों का सूक्ष्म औतकीय एवं औतकीय रसायन परीक्षण भी किया गया।

उच्छिन्नाण्ड जीवों पर प्रभाव

इस परीक्षण के लिए ४० समान शारीरिक तथा समान उम्र के चूहों को लिया गया। सभी चूहों की वृषण ग्रन्थियों को शल्य क्रिया द्वारा निकाल दिया गया। अण्डोच्छेदन के १५ दिन बाद सभी चूहों के दाहिने हाथ की अस्थियाँ उपर्युक्त विधि द्वारा तोड़ दी गई और उन्हें तीन वर्गों में विभक्त किया गया, जैसे, (१) अचिकित्सित (२) चिकित्सित और (३) नियन्त्रित। तृतीय वर्ग को ८ मि० ग्रा० एक्वाविरान प्रति सौ ग्रा० शारीरिक भार की मात्रा में सप्ताह में दो बार मांशपेशीगत अन्तःक्षेपण विधि द्वारा दिया गया। चिकित्सित वर्ग को हड़जोड़ के 'पादप-आनुवंशकीय स्टीरायड' को उपर्युक्त मात्रा में एक दिन के अन्तर पर दिया गया और अचिकित्सित वर्ग को योंही रखा गया। इसमें चूहों की संख्या २० थी, जबकि अन्य वर्गों की दस, दस थी। अचिकित्सित वर्ग में १० चूहों को अस्थिभग्न के एक सप्ताह बाद मार डाला गया। शेष तीनों वर्गों के दस दस चूहों को अस्थिभग्न के दूसरे सप्ताह में मारा गया।

पियूष, गल, अधिवक्र आदि अन्तःस्रावी ग्रन्थियाँ शल्यक्रिया द्वारा निकाली गयी और उनका प्रारंभिक भार मापा गया तथा सूक्ष्म औतकीय परीक्षण किया गया। इसके अतिरिक्त कैपांश काम्ब परोक्षण भी किये गये जिसमें हड़जोड़ के पादप आनुवंशिक सत्व को १६ दिन तक एक दिन के अन्तर पर ४०० मि० ग्रा० की मात्रा में और तदनन्तर एक्वाविरान को १६ मि० ग्रा० १०० ग्रा० शारीरिक भार की मात्रा में दिया गया।

रासायनिक परीक्षण

चिकित्सित और अचिकित्सित वर्गों की तोड़ी गयी हड्डियों को निकाल कर उनका एक्जोसैमीन (राउन्ड और मार्गन, १९५५) तथा हाइड्राक्सी-प्रोलीन (न्यूमैन और लागन, १९५०) नाइट्रोजन मापन माइक्रोजेल्डाल विधि द्वारा किया गया। इन परीक्षणों से प्राप्त परिणामों को तालिका में दिखाया गया है।

परिणाम

सामान्यतः अन्तःस्रावी ग्रन्थियों के भार में वृद्धि रही। पियूष ग्रन्थि में चिकित्सित वर्ग की अपेक्षा भार वृद्धि अधिक थी। चिकित्सित और अचिकित्सित वर्ग की तुलनात्मक समीक्षा की जाय तो चिकित्सित वर्ग में गल एवं अधिवक्र ग्रन्थियों की अपेक्षा वृषण ग्रन्थि में भार की वृद्धि सांख्यकी गणन के आधार पर महत्व की है। इससे पुमणु-जनन (एन्ड्रोजेनिक) प्रक्रिया की वृद्धि का अनुमान होता है। अतः यह देखने के लिए कि हड़जोड़ में पुमणुजनन या उपचय (एनाबोलिक) गुणों में से कौन विद्यमान है केपान्स काम्ब टेस्ट और इन्ड्रोकोनड्रियल आसिफ़िकेशन आदि परीक्षणों से हड़जोड़ में पुमणु-जनन की अपेक्षा उपचय की शक्ति निहित है।

उपर्युक्त अध्ययन से यह निष्कर्ष निकाला जा सकता है कि यह औषधि और डूराबोलिन में अधिकतर सामंजस्य है यद्यपि इसका प्रभाव अधिकतर वृषण के ऊपर पाया गया और कुछ माने में डूराबोलिन से उत्तम सिद्ध होता है। फिर भी इस वानस्पत्य जन्य औषधि का प्रभाव किस प्रकार, कहां पर, किस रूप में होकर अस्थिभग्न में लाभदायक होता है विचारणीय है और इस दिशा में हमलोग आगे अध्ययन कर रहे हैं।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

ANTIFERTILITY EFFECT OF BETAL LEAF STALK (TAMBUL PATRABRINT)
(A preliminary experimental study)

(Km.) P. V. TEWARI*, C. CHATURVEDI** AND S. N. DIXIT***

(*From the Departments of Prasuti Tantra, and Medicinal Chemistry, Post Graduate Institute of Indian Medicine, Banaras Hindu University, Varanasi-5*)

[Received for publication on April 19, 1969]

Introduction

The need of a cheap, easily administrable and effective oral contraceptive is very well recognised. Much work like trial of drugs and several hormonal and other synthetic preparations has been carried out (Kar *et al.*, 1967; Pincus *et al.*, 1964; Crooke, 1965; Roy Choudhary, 1966; W.H.O., 1966). Although they have shown definite efficacy, none of them are free from some side effects and further they are costly. Hence it was thought worthwhile to search the treasure of indigenous drugs to find out a suitable remedy.

Betal roots are being used as antifertility agents with black pepper (*Piper longum*. Lin.) in Orissa (Chunekar, 1967) as well as it is supposed to produce paralysis or atrophy of ovaries. (Nadkarni, 1954).

While the leaf possesses aphrodisiac properties along with aromatic, stimulo-carminative, antiseptic and astringent properties, its thin stalk is reported to have some antifertility effect, so it is removed from leaf while preparing the morsel (Chopra *et al.*, 1958). As no scientific work seems to have been done on this plant to find its antifertility properties, the present experimental study was taken up.

Betal is a well known twining plant cultivated very extensively in warm and moist parts of India and Ceylon for its leaves. It is known by different names in different parts of the country (Latin-*Piper betle* Linn. Piperacea family; Eng.—Betal; Hindi, Sans., Bang., Madra.,—Pan).

Material and Method

The thin stalks of leaves were collected from leaf or morsel sellers, dried, powdered and extracted with absolute alcohol; after evaporating, the residue has been used in the present work. This material named hereafter as betal leaf stalk extract (BLSE), was macerated with gum acacia and suspended in distilled water giving the final dilution as 25mg/ml. Control vehicle was prepared with gum acacia and distilled water only.

The drug was fed to animals by oral intubation in all experiements.

Initially, twenty fertile female albino rats aged between 150 to 180 days, weighing between 120 g to 160 g were selected. They were divided in two groups and were kept in similar husbandary conditions. One group received BLSE in a dose of 50 mg/100g body weight for ten days while the second group received 2 ml of the vehicle only. These, rats were caged with coeval males of proven fertility for 15 days. The efficacy of the drug was noted on the basis

*Reader and Head of the Department. **Lecturer. ***Lecturer.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

of the deliveries after 15 to 20 days of separation of male rats.

To confirm observation made in first series, another series of experiment was planned. Sixty fertile female albino rats of above mentioned criteria having regular estrus cycle for five to seven days were taken (Long, 1922)

These rats were divided in two groups of equal numbers. First group was fed with BLSE 50 mg/100g body weight for three days during diaestrus phase while second group received 2 ml vehicle only and allowed to mate with fertile male rats during next estrus cycle. Successful mating was confirmed by the presence of sperms in vaginal smear examination.

At the end of 20th to 23rd day of the successful mating the number of deliveries as well as litters per rat were noted.

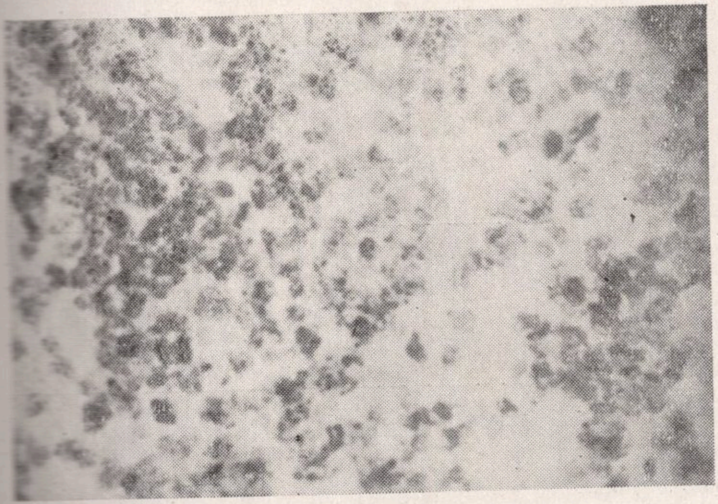


Fig. 1.

Microphotograph of the slide of vaginal smear of a rat in estrus. Note the presence of matted desquamated epithelial cells. No. W.B.C. or R.B.C.

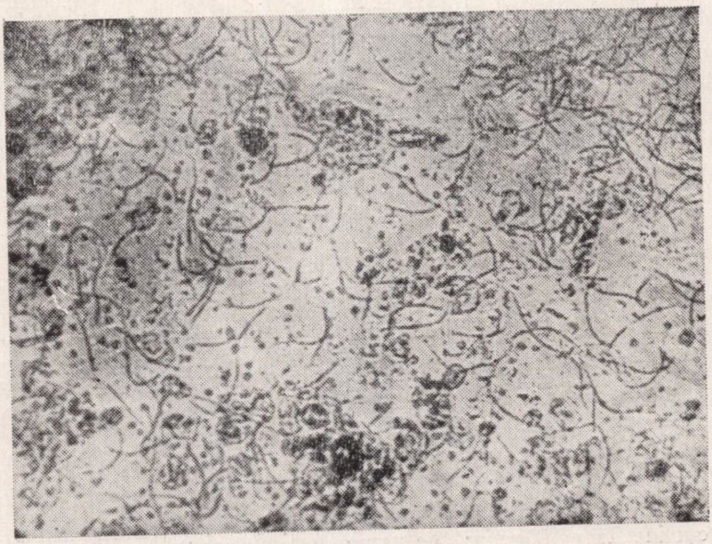


Fig. 2.

Microphotograph of the slide of vaginal smear showing presence of sperms.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

To study the estrogenic activity of BLSE, method described by Lauson *et al.* (1939) was adopted. Thirty female albino rats aged between 22 to 24 days weighing between 35 to 45 g were divided into three groups of equal number. Group one was given BLSE 50 mg/100 g body weight, group 2nd vehicle and group 3rd Neoclinesterol 150 μg/100 g body weight for four consecutive days. On the fifth day the animals were sacrificed after noting their vaginal openings. The uteri were separated from the vagina by cutting through the cervix and the uterotubal junction severed after stripping off the surrounding tissue. The weights of uterus with fluid, and after expression of the fluid on wet blotting paper were taken, weight of both ovaries together was also noted.

Antiestrogenic properties were also studied. The mature female rats were oophorectomized by abdominal route, and were given 150 μg/100g body weight of stilbestrol injection subcutaneously as a priming dose. After one week another dose was repeated and viginal smears examined for cornification. The rats not responding with stilbestrol were rejected. Thus obtained twelve rats were divided in two groups of six each. One group was fed with 150 μg/100g body weight of neoclinesterol while second group received BLSE 50 mg/100g alongwith above mentioned dose of neoclinesterol. The vaginal smears were studied on 2nd, 3rd and 4th day for cornification (Lerner *et al.* 1958).

For studying the progestational activity twelve immature female rabbits weighing between 500 to 750 g were injected stilbestrol 150 μg subcutaneously for five days. After this estrogen priming, the animals were divided into two groups. Group one of six animals received BLSE 50 mg/100g body weight for five days, while second group was given leutocycline 1mg/100g for the same period. On sixth day all the animals were sacrificed ; uterine horns and ovaries separated and sectioned (McPhail, 1934). Similar process of medication was also repeated in female albino rats after spaying.

Results

ANTI-FERTILITY EFFICACY

In the first group of experiment only two rats out of ten receiving BLSE gave birth to the litters while 9 rats out of 10 delivered in the vehicle-fed group. The number of litters per delivery too was less in the BLSE group.

Table 1

Showing number of deliveries alongwith the litter numbers per rat

Drug and Dose	Total No. of observations.	No. of delivered rats.	Mean No. of Litters per delivered Rat.
BLSE 50mg/100g body weight	10	2	3
Vehicle 2ml/100g body weight	10	9	6

Similar findings were observed even in the second series of experiment as evidenced from the following table

Table 2

Showing the no. of deliveries alongwith litter no. in the rats treated in diaestrus phase.

Group	Drug and dose	Total No. of observations.	No. of deliveries	No. of litters per delivered Rat.
1	BLSE 50mg/100g body weight for three days	30	8	3.5
2	Vehicle 2ml/100gm body weight for three days.	30	29	7

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

HORMONAL PROPERTY

Estrogeic and Anti-Estrogenic Activity

BLSE does not seem to have any estrogenic property as there was no increase of uterine weight (with and without fluid) or ovarian weight as compared to vehicle-fed group. Vaginal opening too was not of any significance.

BLSE does not seem to have any anti-estrogenic property, as it did not hamper the normal cornification of vaginal epithelium in ovarectomized rats when given with neoclinesterol.

Progestational Activity

The BLSE was found to have mild progestational activity when given in immature estrogen primed rabbits but at the same time there seems to be some follicle depressant type of action as several graffian follicles were seen in their regressive phase when ovaries were sectioned.

Similar results were obtained in rats which were treated after spaying.

Discussion

The results show very clearly that BLSE has definite anti-fertility activity, in second

Table 3

Showing mean weight of ovaries and uterus and percentage of vaginal opening

Group	Drug & Dose	No. of observation	Mean weight of uterus in mg. With fluid	Mean weight of uterus in mg. Without fluid	Mean Wt of Ovaries in mg.	Percentage of vaginal opening
1	BLSE 50mg/100g body weight for four days	10	18.6	17	15.3	20%
2	Vehicle 2ml/100g body weight for four days.	10	20.9	18.6	9.5	20%
3	Neoclinesterol 150µg/100g body weight for four days.	10	101.6	75.5	21.5	100%

Fig. 3. (Magni. 4×7) Microphotograph of the section of Rabbit's uterus after estrogen priming; showing growth of endometrium as a whole with marked villi formation.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

series of experiment. Where BLSE was fed in diaestrus phase, it was observed that it did not alter the normal estrus cycle of animals, nor it had any estrogenic or anti-estrogenic property.

From the histological studies of uteri of spayed rats and rabbits, BLSE seems to have a mild progestational activity. Hence it can be presumed that this mild progestational property might be hampering normal maturation of follicle by suppressing the formation of gonadotrophic hormone of anterier pituitary, without altering the estrogen level. This finding is confirmed by the ovarian sections, where a few follicles were seen in the phase of regression after BLSE treatment.

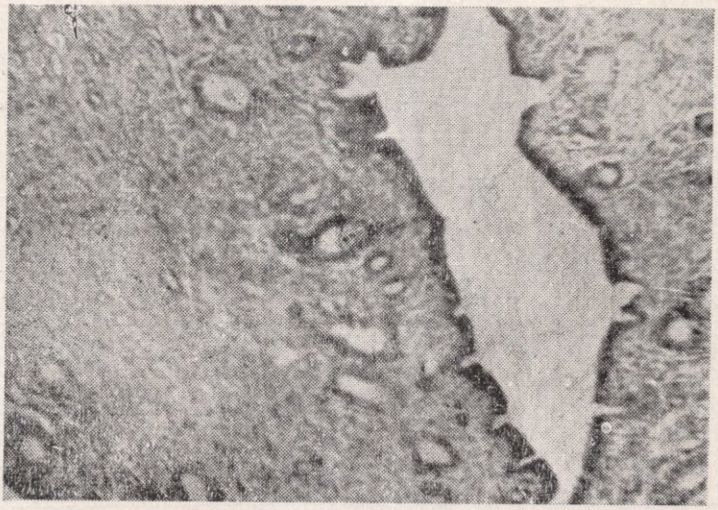


Fig. 4.
(Magni. 10×7) Microphotograph of the section of estrogen primmed rabbit uterus after BLSE treatment. Note the mild progestational proliferation and enlargement of glandular cells, discontinuation of typical endometrial lining at certain places and construction of lumen for a greater extent.

Fig. 5.
(Magni. 4×7) Microphotograph of the section of ovary after BLSE treatment showing the presence of lutine cells indicative of functioning corpora lutia, several follicles are seen in their regression phase.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Summary

The whole alcoholic extract of betel leave stalk has been studied for its antifertility and and hormonal properties in rats and rabbits. In the fertility tested female albino rats when given for ten days continuously in one group and for 3 days during diaestrus phase in second group it has been found to have some anti-fertility effect.

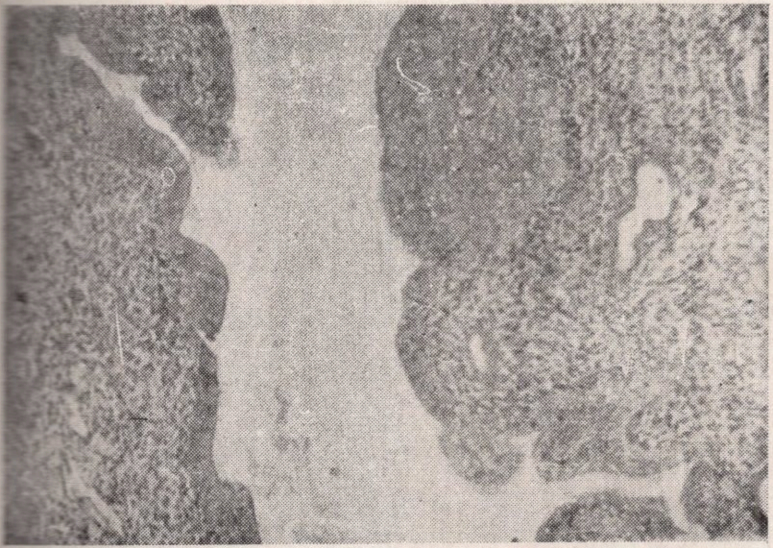


Fig. 6.
(Magni. 4×7) Microphotograph of the section of overectomized rat's uterus after estrogen priming showing thickening of endometrium with generalised hypertrophy.

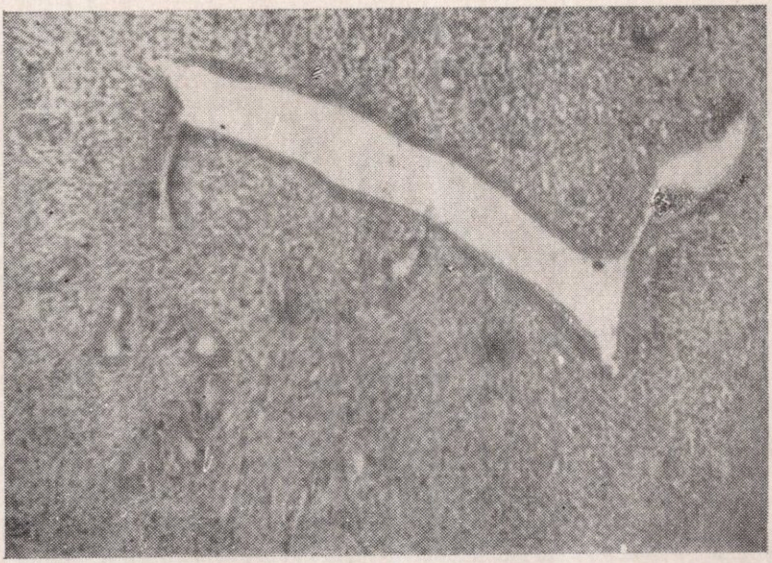


Fig. 7.
(Magni. 4×7) Microphotograph of the section of rat's uterus after BLSE treatment showing mild progestational activity. Note much more proliferation of glandular cells with typical enlargement and more collection of these cells in the endometrium near the uterine lumen, constriction of lumen, discontinuation of endometrium at certain places.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

It does not show any estrogenic or anti-estrogenic activity in immature and spayed types of animals. It seems to have mild pro-gestational activity in immature rabbits and spayed albino rats. This mild progestational activity may be responsible for its antifertility activity.

ACKNOWLEDGEMENT

The authors are highly greateful to Prof. J. P. Thepaliyal for his kind opinion regarding the histological sections of different animals. Thanks are also due to Prof. K. N. Udupa, Principal College of Medical Sciences, Banaras Hindu University and Prof. P. V. Sharma, Director of the Post Graduate Institute of Indian Medicine, Banaras Hindu University for their constant encouragement and guidance.

REFERENCES

Crooke, A. C. (1965) ... The endocrinological basis of birth control. The Practitioner, 194 : 463.

Chunekar, K. C. (1967) ... Bhav Prakash Nighantu, Hindi trans. 3rd ed., p. 274. Chowkhamba Vidya Bhawan, Varanasi.

Chopra, R. N., Chopra, I. C., Handa, K. L. and Kapur, L. D. (1958) ... Chopra's indigenous drugs of India, 3rd ed., p. 372, U. N. Dhur & Sons, Pvt. Ltd., Calcutta.

Kar, A. B., Kambhoj, V. P. and Setty, B. (1967) ... Biological properties of 2-phenyl 3-P B Pyrolidinoethoxy Phenyl-6 methoxy-benzofuran hydrochloride : A new oral anti-fertility agent. Ind. Jour. Exp. Bio., 5 : 80-84.

Long J. A. and Evans, H. M. (1922) ... The oestrus cycle in rats, 1st ed, p. 151. Mem Univ., California.

Lauson, H. D., Heller, C. G., Golden, J. B. and Severinghaus, E. L. (1939) ... Endocrinology, 24 : p. 35, quoted from the book Dorfman : Method in Hormone Research, 2 : (Bioassay), in 1964. Academic Press, New York & London.

Lerner, L. J., Holthous F. J. and Thompson, C. R. (1958) ... *Ibid*. a. 63 : 295

McPhail, M. K. (1934) ... Journal of Physiology, 83 : p. 145. *Ibid*.

Nadkarni, A. K. (1954) ... Indian Materia Medica, 3rd ed., p. 964, Popular Book Depott., Dhoot Papeshwar Prakashan Ltd., Bombay.

Pincus, G. and Baily, G. (1964) ... Drugs used in control of Reproduction : Advances in Pharmacology, 1st ed., p. 285. Academic Press Publication, New York.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

ROY CHAUDHURY, R. (1966) ... Plants with possible antifertility activity, Ind. Cann. Med. Res. 55.

W. H. O. (1966) ... Clinical aspect of oral estrogens. W. H. O. Tech. Rep. Ser. 326.

हिन्दी सारांश

ताम्बूल (पान या नागवल्लरी) पत्रवृन्त का प्रसवन शक्ति प्रतिकारक प्रभाव : एक प्रायोगिकी प्रारम्भिक अध्ययन

कुमारी प्रेमवती तिवारी, चन्दन चतुर्वेदी एवं सरजू नारायण दीक्षित

(प्रसूति तंत्र विभाग, औषधीय रसायन विभाग, स्नातकोत्तर आयुर्वेदीय संस्थान काशी हिन्दू विश्वविद्यालय, वाराणसी—५)

प्रस्तावना

आधुनिक जगत में सस्ती, सुगमता से ग्राह्य, मुखमार्ग द्वारा प्रभावकर गर्भनिरोधक औषधियों की एक विशेष आवश्यकता है। हालही में औषधियों के परीक्षण के नाम पर कुछ हारमोन्स अथवा संश्लेषित द्रव्यों पर अध्ययन किया गया है (कार, १९६७; पिकंस, १९६४; कुक, १९६५; रायचौधरी, १९६६; विश्व स्वास्थ्य संगठन, १९६६)। यदि हम इन औषधियों के गुणों पर विचार करें तो उनकी उपयोगिता की दृष्टि से होने वाले घातक प्रभाव तथा खर्च दोनों ही अधिक है। इसलिए उपयोगी चिकित्सा की दृष्टि से आयुर्वेदोक्त औषधि द्रव्यों का परीक्षण अनिवार्य समझा गया, इस दृष्टि से पानमूल पिप्पली के साथ उड़ीसा में (चुनेकर, १९६७) गर्भ निरोधक के रूप में, तथा डिम्ब प्रणाली की निष्क्रियता उत्पादक प्रभाव डालने का उल्लेख मिलता है (नादकर्णी १९५४)। ताम्बूल पत्र में कामोद्दीपक अथवा वाजीकर और स्तम्भक गुण तथा इसके पत्रवृन्त में गर्भनिरोधक शक्ति के कई उल्लेख आ े हैं। इसी लिए चोपड़ा आदि ने १९५८ में इसके पत्रों को कण रूप में बनाते समय पत्रवृन्त को अलग कर देने का उल्लेख किया है। वस्तुतः इसकी गर्भ निरोधक शक्ति के विवेचन से सम्बन्धित कोई वैज्ञानिक प्रयोग नहीं किये गये अतः इन त्रुटियों को ध्यान में रखकर इसे उपर्युक्त अध्ययन के लिए चुना गया।

सामग्री और विधि

इसके पत्रवृन्त को पत्ते से अलग कर सुखाया गया। उनका अल्कोहलीय सारतत्व प्राप्त किया गया। इस सारतत्व को गमअकेसिया और परिश्रावित जल के साथ मिश्रित किया गया तथा उसकी मात्रा को २५ मि० ग्रा० प्रति मि० ली० की मात्रा में चिकित्सित वर्ग के चूहों को देने के लिए बनाया गया। दूसरी ओर गमअकेसिया तथा परिश्रावित जल से युक्त अत्युनिरोधी (प्लेसिबो) ? तैयार किया गया। इन दवाइयों को उत्तरीय नलिका द्वारा दिया गया।

प्रारम्भिक अवस्था में २० मादा प्रजनन शक्ति युक्त १५० से १८० दिन की आयु वाले तथा १२० से १६० ग्रा० भार वाले चूहों को लिया गया। चूहों को दो वर्ग (१) चिकित्सित (२) अचिकित्सित वर्गों में

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

विभाजित कर दिया गया। चिकित्सित वर्ग को ५० मि० ग्रा० प्रति १०० ग्राम शारीरिक भार की मात्रा औषधि के सत्व को तथा अचिकित्सित वर्ग को केवल दो मि०ली० प्लेसिबो १० दिन तक दिया गया। एवं उनको प्रजननशक्ति-परीक्षित नर मूषको के साथ १५ दिन तक रखा औषधि के प्रभाव को नर चूहों को १४-२० दिन तक अलग रखकर प्रसवों के आधार पर मापा गया।

उपर्युक्त प्रयोग की अध्ययन सामग्री के प्रतिष्ठापन के लिए दूसरा प्रयोग भी किया गया। इस प्रयोग के निमित्त पहले जैसे ६० मादां चूहों को लेकर दो भागों में विभाजित किया गया। प्रथम वर्ग को ५० मि० ग्रा० प्रति १०० ग्रा० शारीरिक भार की मात्रा के आधार पर औषधि सत्व को तीन दिन तक डायाईट्रस अवस्था में दिया गया। जबकि आचिकित्सित वर्ग को केवल २ मी० लि० प्लेसोबो दिया गया। इनको नर चूहों के सम्पर्क में अगले आर्तव काल में आने दिया गया। मैथुन क्रिया को योनिमार्ग गत पुंबीज की विद्यमानता पर निर्धारित किया गया। मैथुन क्रिया के अन्त में २३ दिन के २० से बाद प्रसवो की संख्या एवं, बच्चे प्रति चूहे के हिसाब से औषधि शक्ति का मापन किया गया।

स्ट्रोजनिक प्रक्रिया के अध्ययन के लिए लाउसन आदि (१९३९) की विधि का अनुसरण किया गया। इस प्रयोग के लिए ३० मादा श्वेत चूहों को २२ से २३ दिन की आयु तथा ३५ से ४५ ग्राम शारीरिक भार की स्थिति में लिया गया। उन्हें तीन बराबर वर्गों में बांटा गया। प्रथम वर्ग को २ मी० लि० प्लेसिबो, द्वितीय को औषध सत्व जैसा की पहले दिय गया था तथा तीसरे वर्ग को निओक्लोनेस्टेराल १५० माइक्रो-ग्राम प्रति १०० ग्राम शारीरिक भार की मात्रा में चार दिन तक लगातार दिया गया। पांचवें दिन उनको मार कर योनिमार्ग, योनिमुख परीक्षण और गर्भाशय तथा डिम्बग्रन्थि का भार मापा गया।

एण्ट्रीस्ट्रोजनिक गुणों का भी अध्ययन किया गया। इसके लिए परिपक्व मादा चूहों का उदर मार्ग से डिम्बग्रन्थि निकाल लिया गया तथा उन्हें १५० माइक्रो-ग्राम प्रति १०० ग्रा० शारीरिक भार की मात्रा में स्टिलवेस्ट्राल का अधोचर्मगत अन्तःक्षेपण किया गया। एक सप्ताह के बाद पुनः इसी मात्रा को दोहराया गया तथा योनिमार्ग के **कार्नीफिकेशन** के लिए परीक्षा किया गया। जिन चूहों पर स्टिलबेस्ट्राल का प्रभाव नहीं देखा गया उन्हें छोड़ दिया गया। इस प्रकार १२ चहे प्राप्त किये गये तथा उन्हें दो वर्गों में विभक्त कर दिया गया। एक वर्ग को पूर्व कथित मात्रा में **निओक्लेनेस्टराल** तथा दूसरे वर्ग को पान का अल्कोहलीय सारतत्व दिया गया। दूसरे, तीसरे और चौथे दिन कार्नीफिकेशन के अध्ययन के लिए योनिमार्ग गत स्मीयर्स लिये गये।

प्रोजेस्टेशनल क्रिया के अध्ययन के लिए १२ अपरिपक्व मादा शशकों को जिनका शारीरिक भार ५०० से ७०० ग्राम के बीच था लिया गया। उनको स्ट्रिलबेस्ट्राल १०० माइक्रोग्राम की मात्रा में दिया गया। तदनन्तर इन जीवों को दो भागों में बांटा गया। प्रथम वर्ग को औषधिका अल्कोहलीय सारतत्व तथा दूसरे वर्ग को ल्यूटोसाइक्लिन १ मि० ग्रा० प्रति १०० ग्रा० की मात्रा में ५ दिनों तक दिया गया। छठवें दिन उन्हें मार कर उनकी डिम्बग्रन्थि तथा गर्भाशय की कोशाओं को औतकीय परीक्षण के लिए लिया गया। इसी प्रयोग को मादा चूहों में डिम्बग्रन्थि उच्छेदन के बाद करके देखा गया। इन प्रयोगों के विवरण तालिकाओं में प्रस्तुत किये गये हैं।

निष्कर्ष

इसमें स्ट्रोजनिक अथवा एन्टी स्ट्रोजनिक प्रक्रिया का अपरिपक्व चहों अथवा डिम्बग्रन्थि उच्छेदित चूहों में कोई प्रभाव नहीं देखा गया। थोड़ा सा प्रोजेस्टेशनल प्रक्रिया अपरिपक्व शशकों में तथा मादा बन्धित चूहों में पायी गयी। प्रोजेस्टेशनल क्रिया इसके गर्भ निरोधक गुण के लिए उत्तरदायी हो सकती है।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

pig and albino rat and tracheal chain of dog) in an isolated organ bath. Papaverine was used for comparison. Acetylcholine bromide, histamine dihydrochloride, 5-hydroxytryptamine creatine sulphate, barium chloride and oxytocin were used as spasmogens on selected tissues. Spasmolytic ED_{50} of the drug and papaverine were estimated on the same tissue using the same spasmogen. Three to five experiments were conducted with each spasmogen and each tissue.

2. FROG RECTUS ABDOMINIS MUSCLE

The effect of the drug on isolated skeletal muscle of frog was studied in an isolated organ bath. Spasm of the muscle was induced by acetylcholine and potassium chloride. Three experiments were conducted.

3. FROG HEART

Effect of the drug was studied on perfused frog's heart. Frog heart was also rendered hypodynamic by perfusing with Ringer solution containing 1/4 the usual calcium chloride. Five experiments were conducted.

4. ANAESTHETISED DOG

Mongrel dogs of either sex, weighing between 12-16 kg were anaesthetised with pentobarbitone sodium (35 mg/kg I.P.). Carotid blood pressure, heart rate and respiration were recorded. Contractions of the intestine *in situ* were also recorded in some experiments using a Cushney's myocardiograph. All drugs were injected intravenously. Eight experiments were conducted.

5. BILIARY SECRETION OF ANAESTHETISED DOG

Mongrel dogs of either sex, weighing between 8-12 kg were fasted for 24 hours and then anaesthetised with pentobarbitone sodium (35 mg/kg I.P.). The upper abdomen was incised by a midline incision and the liver, gall bladder, common bile duct and cystic duct were identified. The cystic duct was ligated and the common bile duct cannulated close to its termination. The volume of biliary secretion was noted every half an hour. The drug was injected intravenously in a single dose of 30 mg/kg only after two successive half-hourly bile samples were of nearly equal volume. This usually required sixty to ninety minutes. The effect of the drug on bile flow was noted for two and half hours. Total solids/ml were determined in each half-hour bile sample. Six experiments were conducted. In two experiments equivalent volume of normal saline only was administered to serve as an experimental control.

6. CENTRAL NERVOUS SYSTEM

The drug was tested for anticonvulsant (Metrazol, 70 mg/kg S C. induced convulsions and electro-shock induced convulsions), analgesic (rat tail-hot wire method), pentobarbitone sodium (30 mg/kg I. P.) hypnosis potentiating activity and effects on general behaviour in albino rats. The drug was administered in doses of 100 and 200 mg/kg orally. Appropriate controls were kept in each experimental setup.

7. URINARY AND FAECAL OUTPUT

Effect of the drug on urinary excretion and faecal output was studied on albino rats kept in metabolic cages in groups of five. Doses of 100 and 200 mg/kg were administered orally. Senna (50 mg/kg) and urea (1.0 g/kg) were used as controls for faecal output and urinary excretion studies, respectively. Cross over studies were conducted after a week's interval.

All doses and concentrations of the drug have been expressed in terms of the dry weight of the extract.

Results

1. SMOOTH MUSCLES

The drug showed a moderate to marked relaxant effect on the isolated ileum of rabbit, guinea pig and albino rat in the doses of

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

0.1—1.0 mg/ml The relaxant effect of 0.1—0.5 mg/ml of the drug on rabbit ileum was approximately equal to 2.5 mcg/ml of papaverine (Fig. 1). The drug also showed marked relaxation and diminished the spontaneous rhythmic contractions of isolated rat uterus in concentrations of 0.1—0.2 mg/ml, which was comparable to 2—5 mcg/ml of papaverine (Fig. 2). A similar effect was seen on spontaneously contracting isolated guinea pig uterus.

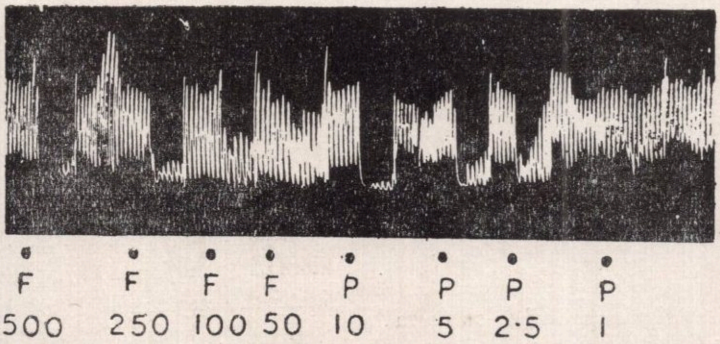


Fig. 1. Effect of *F. parviflora* tertiary alkaloids (F) on isolated rabbit ileum. Note the relaxant effect of the drug in different doses as compared to equi-relaxant doses of papaverine (P). All doses are in mcg/ml.

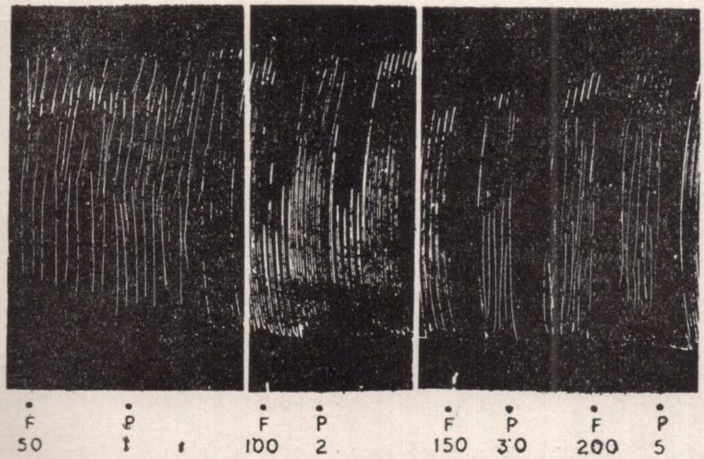


Fig. 2. Effect of *F. parviflora* tertiary alkaloids (F) on isolated spontaneously contracting rat uterus. Note the relaxant effect and inhibition of uterine contractions induced by different doses of the drug as compared to equi-effective doses of papaverine (P). All doses are in mcg/ml.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

The drug showed a non-specific spasmolytic activity against spasms induced by a variety of spasmogens on different tissues. The spasmolytic ED_{50} was determined in each case and compared with papaverine. The results are tabulated in table 1.

2. FROG RECTUS MUSCLE

The drug had no effect on acetylcholine (1 mcg/ml) and potassium chloride (3 mg/ml) induced spasms on frog's rectus abdominis muscle in concentrations of 50-100 mg/ml Papaverine also showed no activity upto a dose of 1 mg/ml.

3. FROG HEART

The drug had no significant effect on normal as well as hypodynamic perfused heart of frog in doses of 50-100 mg. Papaverine also failed to show any significant effect upto a dose of 1-2 mg.

4. ANAESTHETISED DOG

The drug in the doses of 5-30 mg/kg intravenously, had no significant effect on anaesthetised dog's blood pressure, heart rate and respiration. In these doses, however, there was a moderate to marked relaxation of intestine *in situ*. The relaxation produced by 10-15 mg/kg of the drug was comparable to the effect induced by 0.1-0.15 mg/kg of papaverine. The obvious difference with equi-relaxant doses of the drug and papaverine, was the hypotensive action produced by papaverine while the drug had practically no effect on blood pressure (Fig. 3).

5. BILIARY SECRETION IN ANAESTHETISED DOG

The drug was tested in a single intravenous dose of 30 mg/kg During the first 30 minutes, after the experimental set up, the biliary flow was high. Thereafter the flow reduced significantly and usually stabilised by 90 minutes. Though the volume of biliary flow reduced with time in the pre-injection phase, the total solid concentration remained fairly constant. The drug was injected 90 minutes after the experimental set up when the bile flow had stablised. The bile volume started increasing after the drug

Table 1

Spasmolytic ED_{50} of the Total Tertiary Alkaloids of *F. parviflora* and papaverine hydrochloride against different spasmogens.

No.	Spasmogens	Tissue	ED_{50} (mg/ml) Papaverine (Pap.)	ED_{50} (mg/ml) F. parviflora (F.P.)	Relative potency ED_{50} of F.P./ ED_{50} of Pap.
1.	Acetycholine bromide (.01 mcg/ml)	Rat ileum	.0065	0.63	94
2.	Acetylcholine bromide (0.1 mcg/ml)	Rabbit ileum	.016	2.8	175
3.	Acetylcholine bromide (0.1 mcg/ml)	Dog tracheal chain	.039	5.9	151
4.	Histamine dihydrochloride (0.1 mcg/ml)	Guinea pig ileum	.0053	0.77	145
5.	5-Hydroxytryptamine-creatine sulphate (0.5 mcg/ml)	Rat uterus	.005	0.33	66
6.	Barium chloride (0.3 mg/ml)	Rabbit ileum	.003	1.4	466
7.	Oxytocin (.001 U/ml)	Rat uterus	.002	0.85	425

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

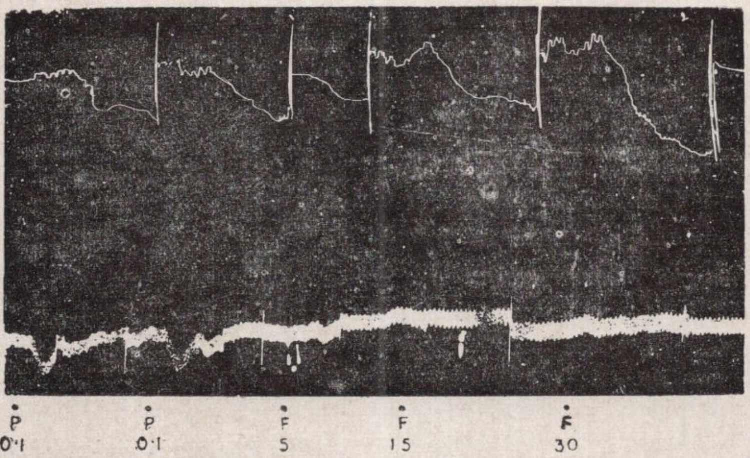


Fig. 3. Effect of *F. parviflora* tertiary alkaloids (F) on blood pressure and intestine of dog *in situ*. Upper part of the tracing denotes intestinal movements. Note the moderate to marked relaxation of intestine in different doses with no effect on blood pressure, induced by the drug. Papaverine (P) induced both relaxation of intestine and hypotensive response. All doses are in mg/kg i.v.

administration and reached its peak at 60 minutes when the bile volume became almost double. Thereafter, there was a steady decline but even at 150 minutes after the drug injection, the bile flow was about 40% more than the pre-injection level (Fig. 4). A study of the total solid concentration of the bile showed that after drug administration, the total solids/ml had diminished and that the bile had become more dilute. It was apparent that the increase in bile volume was due to increase in the fluid portion of the bile and not due to any rise in the solid constituents (Fig. 5). In the experiments where only equivalent volume of saline was administered, there was no change in bile flow.

6. CENTRAL NERVOUS SYSTEM

The drug in doses of 100-200 mg/kg orally had no effect on the general behaviour of albino rats, nor did it show any anticonvulsant, analgesic or barbiturate induced hypnosis potentiating effect.

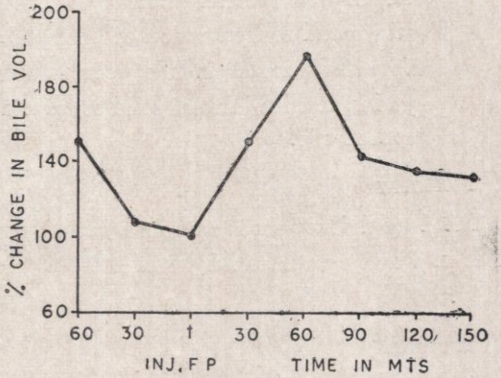


Fig. 4. Effect of *F. parviflora* tertiary alkaloids (F.P. 30 mg/kg i.v.) on biliary flow of dogs. Note the increase in bile volume, reaching a peak level by 60 minutes and persisting even after 150 minutes of drug injection.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

7. URINARY AND FAECAL OUTPUT

The drug in the doses of 100-200 mg/kg orally in albino rats, did not have any significant effect on urinary and faecal output.

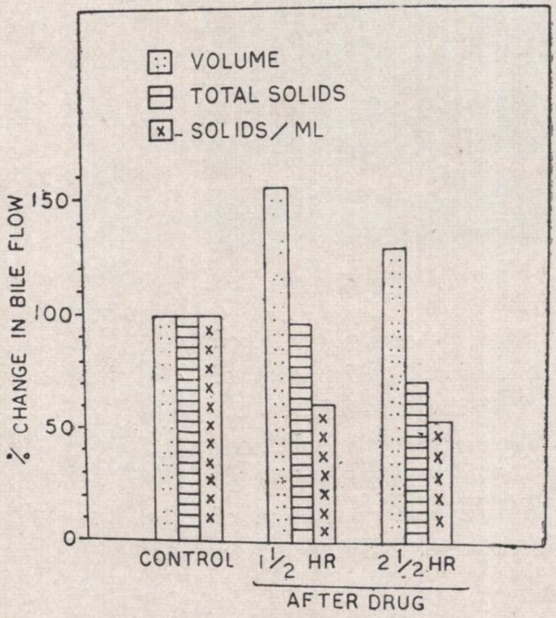


Fig. 5. Histogram showing the effect of *F. parviflora* tertiary alkaloids (30mg/kg i.v.) on bile volume, total solid constituents and concentration of bile solids. Note the increase in bile volume with gradual decline in total solid concentration of bile.

8. TOXICITY

The drug did not show any observable toxic effect in albino rats in the doses of 100-200 mg orally.

Discussion

Fumaria parviflora was found to contain several tertiary alkaloids out of which one appeared to be in relatively large quantity.

The pharmacological studies conducted with the total tertiary alkaloidal fraction showed smooth muscle relaxant, non-specific antispasmodic and choleretic activities. The drug produced relaxation of isolated intestines and uteri of different species of animals. It also markedly relaxed the intestine *in situ* of dog. It showed non-specific antispasmodic activity against a variety of spasmogens *viz.* acetylcholine, histamine, serotonin, barium and oxytocin, on selected tissues. When compared with papaverine, the drug was found to be about 50-100 times less potent as a smooth muscle relaxant and was about 100-500 times weaker than papaverine as a spasmolytic.

The choleretic action of the drug induced by a single intravenous injection, was found on analysis, to be due to a rise in the watery portion of bile with solid constituents diminishing progressively. Hence this can be referred to as a hydrocholoretic effect.

The tertiary alkaloids of the plant were thus found to have papaverine-like pharmacological actions, qualitatively. However, the drug was much less potent than papaverine. The absence of hypotensive action in anaesthetised dog indicates a possible lack of action on blood vessels as against that seen with papaverine. The hydrocholeretic action of the drug is an additional action which is known to be absent in papaverine.

The present study did not substantiate the use of the drug as a diuretic and an aperient in the indigenous system of medicine. However, its use as an alterative and in dyspepsia may be due to its effect on bile secretion. Further work is in progress to isolate the active constituents and establish their individual pharmacological actions with reference to the papaverine-like activity and choleretic action.

Summary

Pharmacological studies have been conducted with the total tertiary alkaloidal fraction of

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Fumaria parviflora. The drug had relaxant and nonspecific antispasmodic activity on isolated intestines of rabbit, guinea pig and albino rat, isolated uteri of albino rat and guinea pig, dog's tracheal chain and dog's intestine *in situ.* It had no significant action on frog's skeletal muscle, cardiovascular, respiratory and central nervous system. It had no effect on urinary and faecal output. On intravenous administration the drug showed a moderate but prolonged hydrocholeretic effect.

The results have been discussed.

REFERENCES

CHOPRA, R. N., CHOPRA, I. C. AND HANDA, K. L. (1958) ... Indigenous Drugs of India, 1st Ed. p. 674, U. N. Dhur and Sons Ltd., Calcutta.

CHOPRA, R. N., NAYAR, S. L. AND CHOPRA, I. C. (1956) ... Glossary of Indian Medicinal Plants, p. 122, Council of Scientific and Industrial Research, New Delhi.

NADKARNI, K. M. (1954) ... Indian Materia Medica, 3rd Ed., Vol. 1, p. 561, Popular Book Depot., Bombay.

हिन्दी सारांश

पित्तपापड़ाके सम्पूर्ण तृतीयक सक्रिय क्षारीय अंशपर भेषजगुण विज्ञानीय प्रारम्भिक अध्ययन

एस० के भट्टाचार्य, आर० लाल, ए० के० सान्याल, बी० दास गुप्ता एवं पी० के दास

(भेषजगुण विज्ञान विभाग, चिकित्सा विज्ञान महाविद्यालय एवं भेषजीय रसायन विभाग, स्नातकोत्तर आयुर्वेदीय संस्थान, काशी हिन्दू विश्वविद्यालय वाराणसी–५)

प्रस्तावना

पित्त पापड़ा (फ्यूमेरिया पारबीफ्लोरा लैम) गंगा के तटवर्ती क्षेत्र में जंगली पौधों के रूप में पाया जाता है। संस्कृत में इसे पर्पटक, बंगाली में बनसल्फा, तमिल में तूसा और तेलगूमें छतारसी कहते हैं। यह सूखा पौधा आंत्रगत कृमियों को नष्ट करने के लिए, मूत्रविरेचक, स्वेदक, सारक, बल्य के रूप में, एवं चर्मरोगों में रक्त-शोधक के रूप में प्रयोग होता आरहा है। चोपड़ा आदि (१९५६, १९५८ और नादकर्णी १९५४) ने इसे उष्णवात (फिरंग), अपची, कुष्ठ, अम्लपित्त व्याधियों में प्रभाव कर बताया है। चूँकि इस वनस्पति द्रव्य पर कोई पादप आनुवंशिक (फाइटोकेमिकल) और भेषजगुण विज्ञानीय अध्ययन नहीं किया गया है. इसलिए इसे प्रस्तुत अध्ययन का विषय बनाया गया है।

सामग्री और विधि

पित्त पापड़ा के चूर्ण को रेक्टीफाइड स्पीरिट के साथ साक्सलेट अपरेट्स में रखकर बाष्पित किया गया उससे प्राप्त मुख्यांश को जल द्वारा पुनः वाष्पित किया गया। इस जलीय घोल में अम्लता अधिक थी, इसका 'पी एच' ४ से ५ के बीच में था। 'मेयर्स रीएजेन्ट' के द्वारा इसमें सफेद प्रक्षेप पाया गया। इसी प्रक्षेप से तृतीयक सक्रिय क्षारीय अंश प्राप्त किया गया इसकी। पुष्टि पेपर-

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

क्रोमैटोग्राम से की गयी। सम्पूर्ण तृतीयक सक्रिय क्षारीय अंश के जलीय घोल के 'पी एच' को सोडियम बाइ-कारबोनेट घोल से ६.५ पर लाकर भेषजगुण विज्ञानीय अध्ययन किया गया।

भेषजगुण विज्ञानीय अध्ययन

(१) **अनैच्छिक मांसपेशियाँ**—इस औषधि के प्रभाव का अध्ययन अनेक प्रकार की अनैच्छिक मांसपेशियाँ जैसे शशक, गिनिया पिग तथा चूहों के गर्भाशय और कुत्ते की श्वाँस नलिकाओं आदि पर किया गया। इन प्रयोगों को आर्गन बाथ पर किया गया तथा तुलनात्मक समीक्षा के लिए पेपावैरीन को चुना गया। एस्टील-कोलीन, ब्रोमाइड, हिस्टैमीन, डाइहाइड्रोक्लोराइड, ५–हाइड्रोक्सी ट्रीप्टामीन, क्रियेटिन सलफेट, वैरियम क्लोराइड और आक्सीटोसिन का प्रयोग इन कोशाओ पर आक्षेपण के लिए किया गया। अन्वेषणी औषधि और पेपावैरीन दोनों का आक्षेपह्रासक 'इ डी' ५० प्रभाव उन्हीं कोशाओं पर आक्षेपकों का तुलना द्वारा मापा गया। इसके पश्चात मेंढ़क के रेक्टस एबडामनिस तथा हृदय पर किया गया। साथ ही साथ कुत्तों की आंत्र एवं पैत्तिकस्राव पर, केन्द्रीय स्नायुमंडल, मूत्र और मल त्याग की मात्रा, का भी अध्ययन किया गया।

परिणाम

पित्तपापड़ा के सम्पूर्ण तृतीयक सक्रिय क्षारीय अंश का भेषजगुणविज्ञान विषयक अध्ययन इस शोध निबन्ध में किया गया है। औषधि का शशक, वण्टमूष और श्वेत चूहे के पृथक्कारित आंत्र पर तथा श्वेत चूहों और वण्टमूष के पृथक्कारित गर्भाशय पर, एवं कुत्ते के पृथक्कारित श्वाँस नलिका मांशपेशी व कुत्ते की यथा स्थापित आंत्र पर शैथिल्यकारी एवं अविशिष्ट आक्षेप नाशक प्रभाव पाया गया। इसका मंडूक के कंकालाय मांशपेशी तथा हृदरक्तवाहिनी, श्वांस-प्रश्वास एवं केन्द्रीय स्नायु प्रणाली पर कोई विशेष प्रभाव नहीं पाया गया। इसका, मल एवंमूत्रनिष्कृति पर कोई प्रभाव नहीं पाया गया। औषधि को अन्तर्शिरा मार्गीय विधि द्वारा प्रक्षेपित करने पर, इसमें दीर्घकालीन उद्पित्तक प्रभाव पाया गया।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4 : 2, 1970.

PHARMACOLOGICAL STUDIES ON CENTELLA ASIATICA LINN (BRAHMA MANDUKI) (N.O. UMBELLIFERAE)

A. S. RAMASWAMY*, S. M. PERIYASAMY** AND (MRS.) N. BASU***

(*Department of Pharmacology, All India Institute of Medical Sciences, New Delhi-16*).

[Received for publication on May 15, 1969]

Introduction

Centella asiatica (Sans: *Brahma manduki*) is a slender trailing and rooting herb commonly growing in marshy places all over India. The whole plant has been used in the indigenous system of medicine for various nervous and skin disorders (*Bhawaprakash*[1a, 1b]). It is used in the treatment of leucoderma, anaemia, inflammations, smallpox and asthma. The drug finds its use as an alterative tonic, diuretic, in epilepsy and in some forms of insanity (Nadkarni, 1954; Chopra *et al.*, 1958). The leaves taken with milk is claimed to improve memory and has high reputation in Ayurvedic system of medicine for use as *rasayana* and is mentioned in ancient texts (*Charaka*[2]) (Mukherji, 1958; Aithal & Sirsi, 1961).

The plant has been subjected to chemical investigations by various workers (Basu, 1947; Boiteau *et al*, 1949*a*). But it is only recently, the chemical structure of the Centella glycosides have been thoroughly studied. The Madagascar variety of Centella has been investigated by Polonsky and co-workers (Boiteau *et al*, 1949b). They have isolated a crystalline glycoside asiaticoside m.p. 230-3°C (Decomp) and the carbohydrate portion contains glucose and rhamnose (Polonsky, 1959). Bhattacharya and Lythgoe (1949) examined the *Centella asiatica* variety found in Ceylon and India. From the Ceylon variety they isolated three triterpene acids, centic acid, centoic acid and centellic acid. From the Indian variety Bhattacharya (1956) has reported the isolation of Indocentoic acid, m.p. 272°.

Recently two Centella glycosides (brahmoside and brahminoside) from the Indian variety of *Centella asiatica* have been isolated and the

---

* Senior Research officer ** Senior Scientific officer *** Chemist

(1a) व्राह्मी कपोतवङ्काच सोमवल्ली सरस्वती ।

(1b) ब्राह्मी हिमा सरा तिक्ता लघुर्मेध्या च शीतला
कषाया मधुरा स्वादुपाकाऽऽयुष्या रसायनी ।
स्वर्या स्मृतिप्रदा कुष्ठपाण्डु मेहास्र कासजित्
विषशोथज्वर हरी······················ ॥

(भा० प्र० गुडूच्यादिवर्ग श्लोक० २८४)

(2) अथेन्द्रस्तदायुर्वेदामृतमृषिभ्यः संक्रभ्योवाच-एतत्त्सर्वमनुष्ठेयम्, अयं च शिवः कालो रसायनानां दिव्याश्चौषधयो हिमवत्प्रभवाः प्राप्तवीर्या; तद्यथा-ऐन्द्री, व्राह्मी, इत्यादि··· । जीवनीयाश्चान्याः पयसा प्रयुक्ताः षण्मासात् परमायुर्वयश्च, तरुणमनामयत्वं स्वरवर्णसम्पदमुपचयं मेधां स्मृतिमुत्तमवलमिष्टांश्चापरान्भावानावहन्ति सिद्धाः ।

(चरक चि० स्था० अ० १ इन्द्रोक्त र० ६)

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

structure of their genin, brahmic acid (m.p. 293°) (Fig. 1) has been established as 2, 6-hydroxy, 23-hydroxy-methyl ursolic acid by Rastogi *et al.* and Basu and Rastogi (1960, 1967). In addition to the Centella glycosides, Isobrahmic acid, betulic acid, and small amounts of stigmasterol also has been isolated.

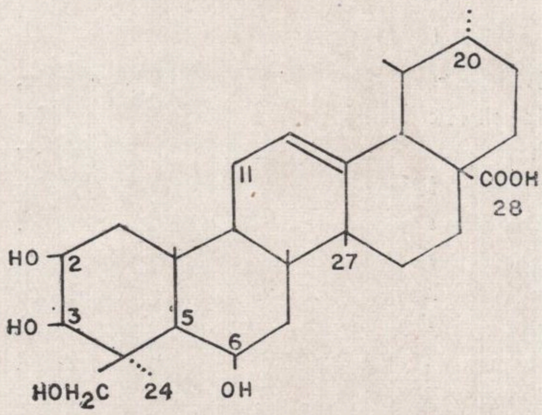


Fig. 1. Brahmoside = Brahmic acid+glu+ara+rha
Brahminoside = Brahmic acid+2glu+ara+rha

The present communication deals with some of the pharmacological investigations carried out on Centella glycosides in view of its high therapeutic importance in the Indian systems of medicine.

Materials and Methods

Centella glycosides (mixture of brahmoside and brahminoside) were used as aqueous solutions in distilled water.

1. *Observations on anaesthetised rats*

Albino rats of either sex, bred and reared in the departmental animal house, weighing between 100-150 g were used for these studies.

2. *Cardiac activity*

The cardiac activity was recorded on isolated rabbit hearts and guinea pig hearts according to Langendorffs technique. E.C.G. Lead II records were taken before and after the administration of the drug in anaesthetised dogs.

3. *Blood pressure*

Blood pressure and respiration were recorded in rats anaesthetised with 25% aqueous solution (175 mg /100 g /body weight). A total of dose of 1 mg of atropine sulphate was given I.P. for atropinisation.

4. *Hexobarbitone sleeping time*

Adult albino mice of weight 20-25 g were injected with 100 mg /kg of hexobarbitone (Evipan, Bayer, Leverkusen) for control studies and for drug studies, different dose schedules were given and 30 min. later, 100 mg /kg of hexobarbitone solutions in distilled water was injected I.P. and the sleeping time recorded (Kuhn *et al.*, 1961).

5. *Amphetamine antagonism*

White male mice (25 gm body weight) were injected intraperitoneally with the drug and the control animals were injected with saline (Piala, 1959). After one hour, they are injected with 10 mg/kg of d-amphetamine. The motor activity is measured by using the actograph and also by observation and arbitrary scores were given, at half hour intervals upto one hour.

6. *Antagonism to tremorine*

Adult mice were treated with tremorine 20 mg/kg body weight intraperitoneally. This dose produces within 15-30 minutes, tremor, salivation, urination and other symptoms of parasympathomimetic effects. Centella glycosides at dosage levels of 50 mg/kg were given and after 15 min. mice were given the standard dose of 20 mg/kg of tremorine, which gave clear cut parasympathomimetic effects. The nature and intensity of tremor were noted (Turner, 1965).

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

7. *Hypothermic action*

The rectal temperature of rats were studied, with the clinical thermometer, every 30 min. upto 4 hours. Groups of 6 rats were used for each dose. The temperature of the control rats ranged between 99-98.8°F during 6 hours. The animals were kept in a room at 21-22°C during the experiment.

8. *Motor activity in mice*

Spontaneous motor activity was studied in mice by recording the total activity of the group of 12 mice in Jaquet's actograph. This device has the advantage in that it provides both a qualitative and quantitative method for continuous recording of the spontaneous motor activity in mice (Fig. 2).

Adult mice of either sex, weighing between 20-25 gm were used in these experiments. All animals were conditioned first, 1 hour daily for over one month. After this schedule was over, the animals were given chlorpromazine as the standard drug. The solution of centella glycosides at different doses of 50 and 100 mg/kg body weight were given i.p. and the motor activity was recorded by the actograph, for one hour.

9. *Isolated smooth muscles*

The effect of *centella glycosides* was studied on isolated guinea pig ileum, and rabbit intestine employing routine methods (Turner, 1965). Antispasmodic effect of the centella glycosides were tested against the spasms of acetylcholine hydrochloride, histamine, serotinin and barium chloride. Varying doses of the test substance were used against each spasmogen and 3-4 experiments were conducted for each dose.

The uterine strips of rats were suspended in de Jalon's perfusion fluid at 29-30°C (Burn, 1952).

Results

In unanaesthetised rats, varying doses of aqueous solutions of centella glycosides were administered to albino rats intraperitoneally. All the animals showed gradual diminished activity and in 15 minutes (after 50 mg/kg) the animals preferred corners of the boxes and were

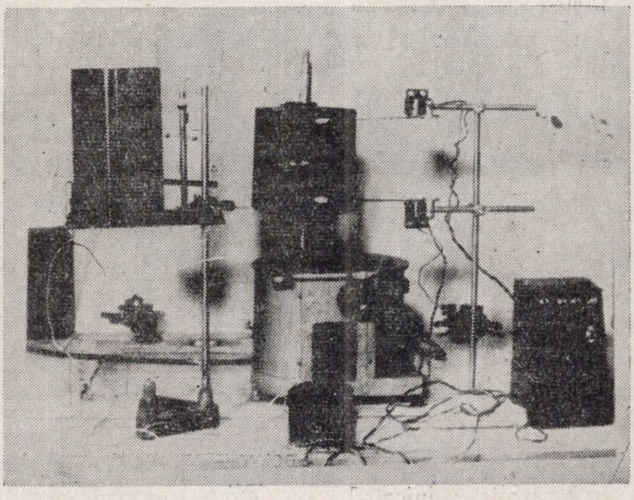


Fig. 2

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

seeking darkened areas of the cage. They reacted normally to touch or to pinching with the fingers. The animals showed no ataxia or incoordination of movements. This effect lasted for about 12-18 hours and then gradually waned by 24 hours.

ACTION ON BLOOD PRESSURE IN RATS

The centella glycosides when injected into anaesthetised rats significantly affected the blood pressure (Fig. 3) but the respiration was unaltered. After atropinisation with 1 mg intraperitoneally, the centella glycosides showed nicotinic effect and twice the amount of the previous dose, significantly increased the blood pressure. The effect on blood pressure showed that acetylcholine is involved in this effect and/or cholinergic receptors are being stimulated. In order to confirm this nicotinic effect, thiamine hydrochloride was given in 10 mg/kg doses and subsequent administration of centella glycosides exhibited no nicotinic effect (Fig. 4). Yamamoto *et al.* (1958) have shown that thiamine hydrochloride antagonises the nicotinic effect. The isosterism of thiamine (Kraut and Reid, 1962) and nicotinium ion structure is given below along with the crystal structure of acetylcholine (Fig. 5). It is likely, that steric factors may be involved in this antagonism, which need further investigation (Fig. 5a and 5b).

CARDIAC ACTIVITY

Studies were conducted on aqueous solution of centella glycosides on isolated rabbits heart showed at dose level (100-500 mg to the perfusion fluid) an initial increase in the amplitude and rate, followed by decrease in the amplitude and rate. Higher doses of the drug tended to stop the heart. After intravenous administration of centella glycosides, in dogs, E.C.G. changes were not markedly altered.

HEXOBARBITONE SLEEPING TIME

With 100 mg/kg of hexobarbitone injected intraperitoneally, the mean sleeping time was observed to be 19.43 min. Chlorpromazine, and meprobamate increased the sleeping time. Fig. 6 shows the percent increase in sleeping time with centella glycosides, chlorpromazine and meprobamate, at different dosage levels. This effect was still detectable at 24 hours, but not 2 days after injection (Table 1).

Table 1

Hexobarbitone sleeping time in mice (Temp. 21—22°C).

Drugs and Doses	Hexobarbitone mg/kg /30 min. after the drug	No. of animals	Sleeping time (Min.)
Control	100	6	19.43
Chlorpromazine (5mg)	100	6	43.88
Meprobamate (100 mg)	100	6	39.10
Centella glycosides	100	6	29.43
Centella glycosides (after 24 hours)	100	6	21.3

AMPHETAMINE ANTAGONISM

As it appears from Fig. 7, the lower doses upto 50 mg/kg of centella glycosides did not antagonise significantly the amphetamine induced agitation, in mice but with higher doses (100 and above) the effect was more recognisable. Whereas, chlorpromazine shows significant effect at a level of 5 mg/kg.

Tremorine (1, 4 dipyorrolidino 2-butyne) is an interesting pharmacological tool for the evaluation of antiparkinson drugs.

In this study, pretreatment of mice with centella glycosides at 20 mg/kg and 50 mg/kg level, there was no protection from tremorine tremor. However, there was significant potentiation in all the treated animals.

BODY TEMPERATURE

Effect of centella glycosides on rectal temperature of adult rats recorded with the clinical

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

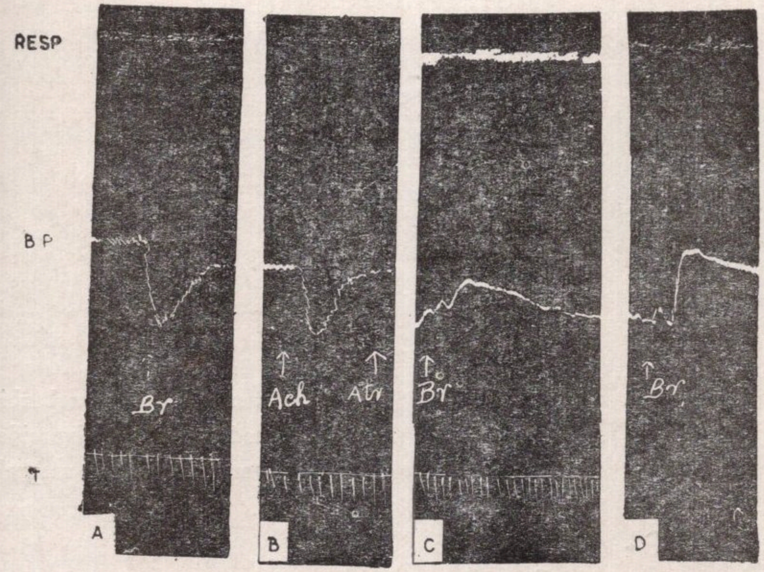


Fig. 3. Effectof centella glycosides on rat blood pressure and respiration.
A=Centella glycosides
B=Acetylcholine, Atr=atropine 1mg given I. P.
C=Nicotine effect, after atropine, with centella glycosides (Br).
D=Higher dose of centella glycosides (Br_1)
T=50 sec.

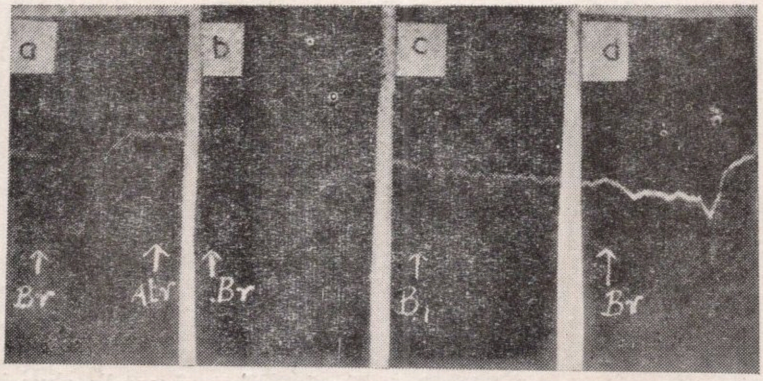
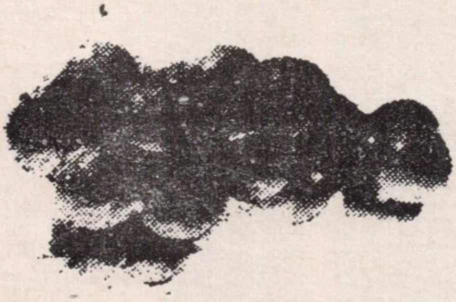


Fig. 4. Effect of centella glycosides showing the block of nicotinic effect by thiamine hydrochloride on rat blood pressure.
a=centella glycosides, Atr=atropine 1 mg., I. P.
b=centella glycosides
c=thiamine hydrochloride 10 mg/kg (15 minutes)
d=centella glycosides after thiamine treatment.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

2



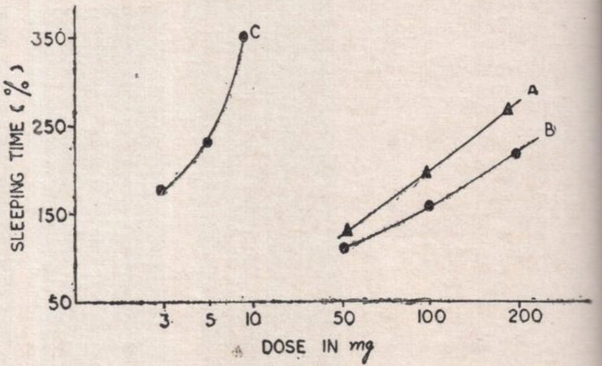


Fig. 6. Potentiation of Hexobarbitone sleeping time by centella glycosides (B), chlorpromazine (C) and meprobamate (A).

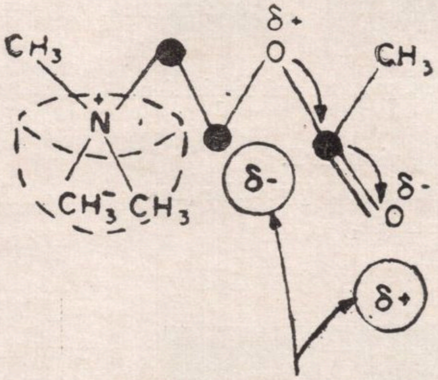


Fig. 5*a*

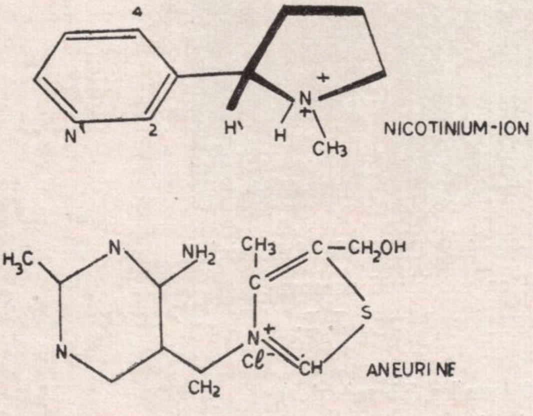


Fig. 5*b*

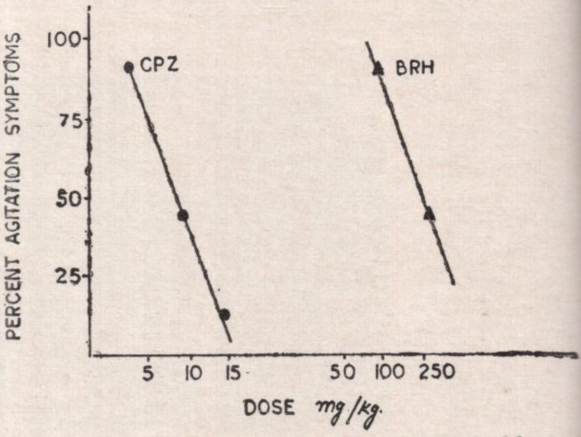


Fig. 7. Effect of centella glycosides and chlorpromazine against amphetamine induced agitation in mice.
CPZ=chlorpromazine,
BRH=centella glycosides
Amphetamine was given 1 hr. after drug treatment.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

thermometer for a period of 4 hours is given in Fig. 8. There was fall in temperature of the order of 1.2°F as compared to the control animals.

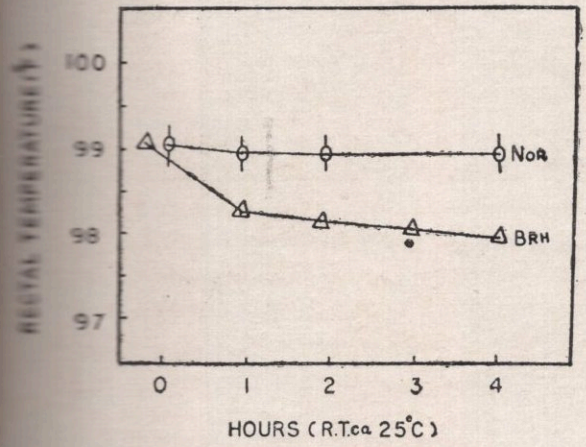


Fig. 8. Mean of rectal temperature of rats.

EFFECT ON SPONTANEOUS MOTOR ACTIVITY

The effects on spontaneous motor activity and drug treated mice was taken into account over a period of 30 minutes. Six animals were used for each dosage level of chlorpromazine and centella glycosides. Chlorpromazine at levels of 0.3 mg and 1 mg was used as standard tranquillising drug. Centella glycosides at levels of 50 mg and 100 mg per kg body weight were used as these were known to reduce motor activity by previous experiments. Thus a total of 36 experiments were conducted and statistically analysed. An interval of 8-10 days were given before the animals were used in the experiments again (Fig. 9).

ISOLATED ORGAN STUDIES

Centella glycosides had a relaxant effect on rabbit duodenum and rat uterus. The relaxant effect was increased with corresponding increase in dose. The spasmolyting action against acetylcholine, histamine and 5HT, and barium spasm was studied. Although, the antispasmodic action was seen against all the spasmogens, the one against 5HT was more pronounced and long lasting (Fig. 10. a, b, c, d). No quantitative study of antispasmodic action has been made in this investigation. It is clear from the findings that the tranquillisation seen at the CNS level, would be greatly augmented by the peripheral antispasmodic action (Fig. 10).

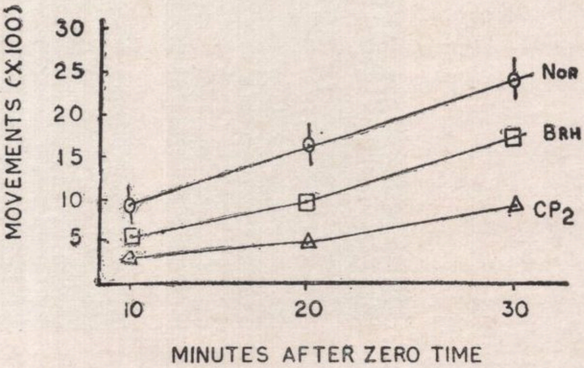


Fig. 9. Effect of centella glycosides (BRH) and chlorpromazine (CPZ) 1 mg/kg on spontaneous motor movements in mice with actograph. Drugs were injected intraperitoneally. Nor=untreated mice.

Discussion

From the results obtained in the present study, it is evident that the centella glycosides (brahmoside and brahminoside) when given at doses of 50—100 mg, produces depression of the central nervous system as revealed by the decrease in motor activity, increase in hexobarbitone sleeping time, and to a small extent reduction in body temperature.

In addition, the centella glycosides, exert their central nervous system effects mainly by the cholinergic mechanism, although the other neurohumoural factors namely 5 HT and histamine cannot be excluded.

Tremorine alters quantitatively the several neurohormones in various regions of the brain. In the present study the centella glycosides acted synergistically with tremorine. The site (s) of

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

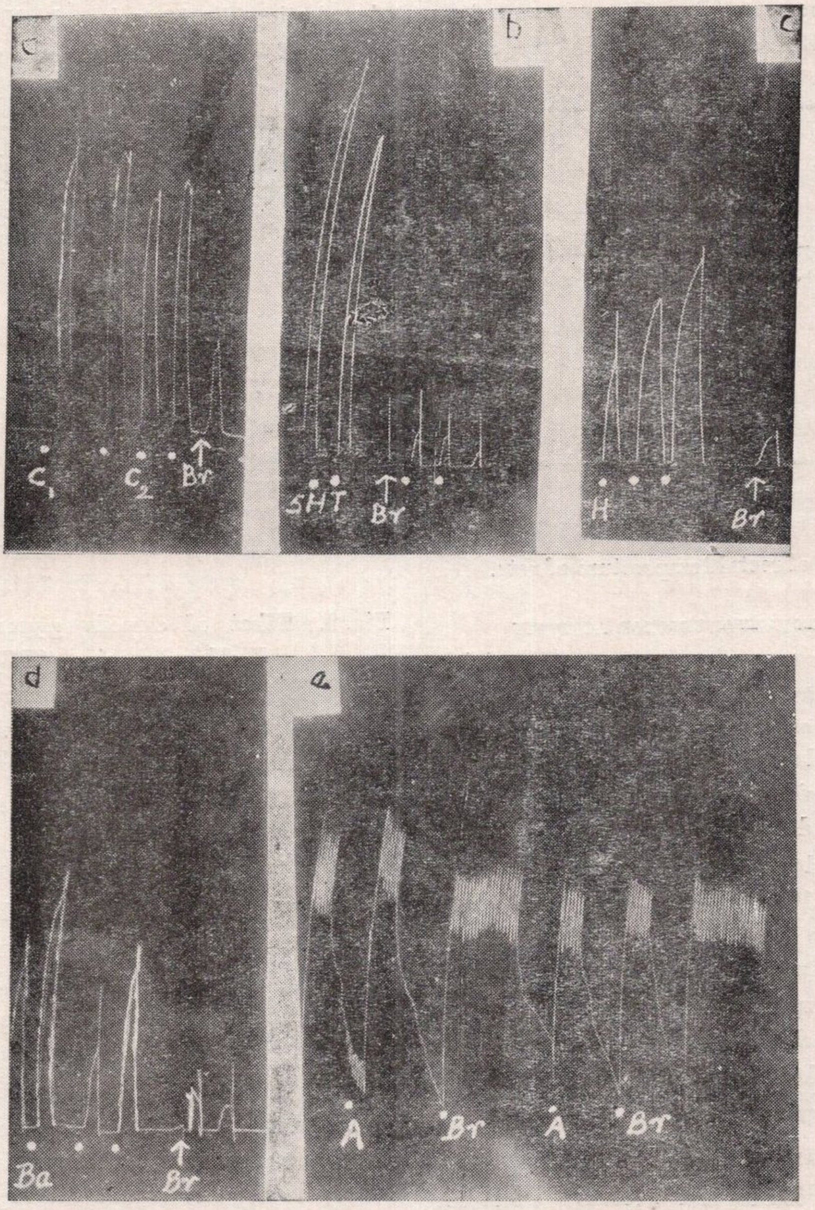


Fig. 10. Effect of centella glycosides on guinea-pig ileum (a, b, c, & d) and rabbit intestine (e).

a=acetylcholine $C_1=2$ μg, $C_2=1$ μg

b=Serotonin 3 μg and 2 μg.

c=Histamine hydrochloride 1, 2 and 3μg

d=Barium chloride, 1 mg, 0.5 mg, 0.75 mg.

e=A=adrenaline 2 μg

Br indicates centella glycosides.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

action of tremorine is not clearly defined, but however the action seems to be due to central action, in addition to its action on the midbrain tegmentum and the parasympathetic activity is abolished by atropine. This suggests that the effect of tremorine is the result of its action on the central cholinergic system.

During recent years the role of γ neurons in the control of muscle spindle activities is being increasingly realized (Granit, 1966). Tremorine in the dog lengthens the silent period produced by a stimulus applied to the α-motor fibre and γ-efferent activity (as monitored by spindle afferents) is augmented by tremorine. The centella glycoside (s) do not antagonise, in our experiments the action of tremorine, but actually is facilitated. The significance of this finding require further detailed investigation.

Cholinereactive system of the brain has been well established recently and they possess selective sensitivity to either arecoline or nicotine and to their respective antagonists, *viz.* atropine, benactyzine, and other cholinolytic agents. Thus the central cholinoceptive systems can be classified as nicotine sensitive or muscarine sensitive, just as the peripheral cholinoceptive systems. (Densinko, 1962).

Sleep produced by the electrical stimulation of the pre-optic area of the hypothalamus or local injection of acetylcholine can be neutralised by the stimulation of cholinergic reticular formation. Cholinergic substances injected into the parts of the limbic system are effective in inducing sleep. In other regions they cause arousal. Barbiturates are considered to exert their hypnotic effect via the block of the reticular formation (Ochs, 1965).

Renshaw cells, located in the ventromedial portion of the ventral horn of the feline spinalcord are excited by 'nicotine' action, whereas the pyramidal cells of the cerebral cortex appear to be of 'muscarine' type. There is some correlation between anti-epileptic activity and acetylcholine blocking activity, but unfortunately diphenylhydantoin, has not been shown to have any action on the cholinoceptive neurons.

It is possible, that cholinoreactive system of the reticular formation of the brain, take part in arousal effect on the cortex and that transmission of impulses between these parts of the brain is mainly affected by cholinergic synapses. By influencing the cholinoreactive structures of the brain, the course of the conditioned and the unconditioned behaviour can also be changed (Ochs, 1965).

The nature of the potentiation of hexobarbitone sleeping time is very complex. The alteration in the time of sleep may be the result of either the effect of the central nervous systems as it is in the case of chlorpromazine and related compounds or to the modification of the barbiturate metabolism as with SKF 525 A (Sethy and Sheth, 1968. Fig. 11).

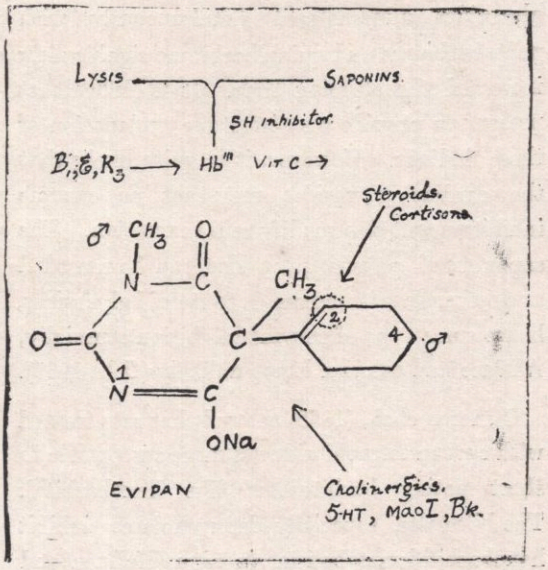


Fig. 11. Some factors involved in hexobarbital sleeping time.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

The duration of pentabarbitone sodium, hypnosis is increased by surface active agents in mice (Cole *et al.*, 1950) and also permeability factors are known to alter barbiturate sleeping time, as in the case, of proteolytic enzymes (Moss *et al.*, 1963). As the saponins function by altering the permeability of the membrane structures this aspect deserves special consideration.

During pentobarbital anaesthesia, Eakins *et al.*, (1968) observe that the fall in temperature is due to norepinephrine turnover being low and this also accounts for the loss of tone in skeletal and cardiac tissues. Iproniazid and other MAO inhibitors prolong the hexobarbital sleeping time (Fouts and Brodie, 1956). Acetylcholine is known to be a week MAO inhibitor, whether this MAO inhibition mechanism can be attributed in the case of centella saponins to cholinergic or adrenergic factors require further investigation.

Ferini *et al.*, (1967) report that cardiac glycosides administered simultaneously with pentabarbitone and quinalbarbitone significantly increased the sleeping time. It is difficult at present to provide a satisfactory explanation of these findings. However, it is quite likely that the cardiac glycosides may act as enzyme inhibitors and also modify renal excretion. The saponins of centella glycosides, can be regarded as closely related compounds to steroid glycosides, hence some type of enzyme inhibition especially, ATPase and calcium is not unlikely (Cole, 1965).

Cameron *et al.*, (1939) showed that rats treated with carbon tetrachloride are more susceptible to short acting barbiturates like hexobarbital. The bile salts, especially deoxycholates inhibit hexobarbital metabolism, *in vitro* (McLuen and Fouts, 1961), it is quite possible, that haemolysis caused by saponins, may accumulate, metabolic products of haemoglobin and other related compounds from haemolysed erythrocytes, which are likely to impair hexobarbital metaboism. Saponins activate the adrenal glands when given in sub-haemolytic doses, and cause an increase in the glucocorticoids and mineralo-corticoid hormones in blood, and further deplete ascorbic acid in the adrenals (Vacek, 1962). Winter *et al.* (1952) reported that cortisone acetate and ACTH, but not desoxycorticosterone acetate, (DOCA) shortened the hexobarbital sleeping time in mice. It is quite possible that the elaboration of corticoid hormones in the case of saponins, also be responsible in increasing the hexobarbital sleeping time.

Amphetamine has been known to exert its toxicity, when mice are grouped together in small space and this overcrowding is responsible for the excitement and death (Chance, 1956). Chlorpromazine and reserpine both provided protection from amphetamine toxicity. (Lasagna, 1957). The present study shows that amphetamine could very effectively antagonise the tranquillizing action of centella saponins in the ranges used. The metabolism of amphetamine depends upon the catecholamines in the storage sites. Since amphetamine resembles closely structurally the catecholamine molecule, they are taken up by the binding sites, and their mechanism of uptake by the storage granules are very similar (Burn and Rand, 1962). In cases where the drugs do not interfere with the uptake, we see, therefore, potentiation of norepinephrine action. Once, the binding and uptake mechanisms are inoperative, the free and active catecholamines remain for a longer period in higher concentration at the vicinity of the receptors. While amphetamine exerts its action at the site of the receptors, recent evidence suggests that certain hyperactive states produced by amphetamine in animals may be due to the

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

increase in catacholamines in the brain, and small elevations in serotinin (Maclean and Mc-Cartney, 1961 ; Sanan and Vogt, 1962). This accounts for the excitement at the level of the central nervous system.

Anxiety or fear, and restrained social interaction is a critical factor in the enhancement of the toxicity of amphetamine in addition to other factors (Moore, 1964).

Askew (1962) attributes amphetamine aggregation toxicity to stress induced hyperthermia. Centella glycosides produce hypothermia of a low order, which is common to most tranquallisers, like chlorpromazine and other thymoleptic agents. Burn (1956) reviewed the literature and suggested that hypothermia results from a decrease in skeletal muscle tone, due to the peripheral action of these drugs. Centella glycosides also exhibit, antispasmodic action to many spasmogens, like acetylcholine, serotonin and barium salts, and it is possible that the centella glycosides also have some effect as an antispasmodic and this may effectively contribute to the tranquillizing action by relaxing tension.

It is pertinant finally to conclude that centella glycosides (brahmoside and brahminoside) bring about their tranquillizing action on the central nervous system and peripherally act as an antispasmodic on the gastro-intestinal and reproductive systems. Thus the drug possess antianxiety or antistress activity by a predominent cholinergic mechanism and possibly along with other factors. In addition, it may stimulate the hypothalamico-hypophyseal axis and thus regulate the endocrinal and other metabolic functions of the body.

Summary

1. Pharmacological studies on the saponins from Centella asiatica (brahmosides) has been studied. The saponins have been found to possess sedative action in animals, which is that of a minor tranquilliser. The details of the neurological deficit has been compared with other drugs, like chlorpromazine and meprobamate.

2. The mode of action appears to be mainly on the cholinergic mechanism in the CNS and this aspect has been discussed and pointed out that the intimate nature of this action requires further study.

ACKNOWLEDGMENTS

The authors' thanks are due to Prof. R. B. Arora for the keen interest in the work and C. Dwarakanath, Indian Council of Medical Research, New Delhi and Pramod K. Gujral, A.I.I.M.S., New Delhi for helpful suggestions and discussions, and to R. P. Rastogi, Central Drug Research Institute, Lucknow for the generous supply of Centella glycosides used in the study.

The authors' grateful thanks are also due to M/s Bayer and Co., Germany, for the gift of Hexobarbitone, Zandu Pharmaceutical Works, Bombay and L. D. Kapoor, Lucknow (U.P.) for the supply of *Centella asiatica*. The financial assistance of Indian Council of Medical Research, New Delhi, is hereby duly acknowledged.

REFERENCES

Aithal, H. N. and Sirsi, M. (1961) ... Preliminary pharmacological studies on Centella asiatica. L. Antiseptic, *58* : 405.

Askew, B. M. (1962) ... Hyperpyrexia as contributing factor in the toxicity of amphetamine to aggregated mice. Brit. Jour. Pharm. Chemotherapy, *19* : 245

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Basu, N. and Rastogi, R. P. (1967) ... Triterpenoid saponins and sapogenins, Phytochemistry, *6* : 1249.

Basu, N. K. and Singh, G. B. (1947) ... Investigation on Indian Medicinal Plants. Quart. J. Pharm. *20* : 135.

Bhattacharya, S. C. and Lythgoe, B. (1949) ... Triterpene Acids. Nature ; *163* : 259.

Bhattacharya, S. C. (1956) ... Constitution of centella asiatica L. (III) Examination of the Indian variety. Jour. Ind. Chem. Soc., *33* : 893.

Boiteau, P. and Buzas, A., Lederer, E. and Polonsky, J. (1949) ... *a.* Constitution of asiaticoside. Nature, *163* : 258

Idem ... *b.* Sur la constitution chimique de lacide asiatique, aglycone de lasiaticoside. Bull. Soc. Chim. Biol. Paris, *31* : 46.

Burn, J. H. and Rand, M. J. (1962) ... A new interpretation of the adrenergic fibre : Advances in Pharmacology, 1, p. 1. (ed. s, Garattini and P. A. Shore). Academic Press, New York.

Burn, J. H. and Rand, M. J. (1956) ... Functions of autonomic transmitters. 1st ed. Williams and Wilkins, Baltimore.

Burn, J. H. (1952) ... Practical Pharmacology, 1st ed Black well Scientific Publications, Oxford.

Cameron, G. R. and De Saram, G.W.W. (1939) ... The effect of liver damage on the action of some barbiturates. Jour. Path. and Bact., *48* : 49.

Chance, M. R. A. (1946) ... Aggregation as a factor influencing the toxicity of sympathomimetic amines in mice. Jour. Pharm. Expt. Therap., *87* : 214.

Chopra, R. N., Chopra, I. C., Handa, K. L. and Kapur, L. D. (1958) ... Indigenous drugs of India, 2nd ed., p. 341 U. N. Dhur and Sons Pvt. Ltd., Calcutta.

Cole, V. V., Hulpien, H. R., and Hopper, S. H. (1950) ... The effect of some surface active agents on the action of some barbiturates. Proc. Soc. Exp. Biol. and Med., *73* : 554.

Cole, V. V. (1941) ... The effect of calcium and strontium salts on the action of sodium pentobarbital. Jour. Pharm. and Exp. Therap., *73* : 335.

Densinko, (1962) ... Pharmacological analysis of central nervous action, 1st ed, Vol. VIII, Proc. First International Meeting. p. 199 Pergamon Press. London.

Eakins, K. E., Costa, E., Katz, R. L. and Reyes, C. L. (1968) ... Effect of pentobarbital on the turnover of (H 3) Nor-epinephrine in the peripheral tissues of cats. Life Sciences, *7* : 71.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

FERRINI, R. AND SCUKA, M. (1967) ... Increased barbiturate sleeping time by simultaneous administration of cardiac glycoside to mice. Jour. Pharm. and Exp. Therap., *19* : 780.

FOUTS, J. R. AND BRODIE, B. B. (1956) ... On the mechanism of drug potentiation by Iponiazid.
J. Pharm. Expr. Thrap. *116* : 780.

GRANIT, R. (1966) ... Muscular afferents and Motor control. Nobel Symposium, I. 1st ed. Almquist and Wiksell, Stockholm.

KRAUT, J. AND REID, H. J. (1962) ... The crystal structure of Thiamine-hydrochloride Acta, Cryst., *15* : 747.

KUHN, W. L. AND VAN MAANEN, E. F. (1961) ... Central nervous system effects of thalidomide. Jour. Pharm. Exp. Therap., *134* : 60.

LASAGNA, L. AND MCCANN (1957) ... Effect of tranquillising drugs on amphetamine toxicity in aggregated mice. Science, *125* : 1241.

MCLUEN, E. F. AND FOUTS, J. R. (1961) ... The effects of obstructive jaundice on drug metabolism in rabbits. Jour. Pharm. and Therap. *131* : 7.

MACLEAN, J. AND MCCARTNEY, M. (1961) ... Effect of d-amphetamine on rat brain noradrenaline and serotonin. Proc. Soc. Exp. Biol. and Med., *107* : 71.

MOORE, K. E. (1964) ... The role of endogenous nor-epinephrine in the toxicity of d-amphetamine in aggregated mice. Jour. Pharm. and Exp. Therap. *144* : 45.

MOORE, K. E. AND LARIVIERE, E. W. (1963) ... Effects of d-amphetamine and restraint on the content of nor-epinephrine and dopamine in rat brain. Biochem. Pharmacol. *12* : 1283.

MOSS, J. N., FRAZIER, C. V. AND MARTIN, G. J. (1963) ... Bromelains. Arch. Inter. Pharmacodyn., *145* : 166.

MUKHERJI, B. (1953) ... Indian Pharmaceutical Codex, 1, p. 60, C.S.I.R. New Delhi.

NADKARNI, A. K. (1954) ... Indian Materia Medica, 1, p. 662. Popular Book Depot. Bombay.

OCHS, S. (1965) ... Elements of Neurophysiology, 1st ed, p. 440. John Willey and Sons., New York.

PIALA, J. J., HIGH, J. P., HASSERT, G. L., JR. BURKE, J. C., AND CRAVER, B. N. (1959) ... Pharmacological and acute toxicological comparisons of Triflupromazine and Chlorpromazine. Jour. Pharm. and Exp. Therap. *127* : 55.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Polonsky, J., Sach, E. and Lederer, E. (1959) ... The chemical constitution of the glucoside parts of asiaticoside Bull. Soc. Chim. France *26* : 880.

Rastogi, R. P., Sarkar, B. and Dhar, M. L. (1960) ... Chemical examination of Centella asiatica Linn., Pt. I—Isolation of the chemical constitutents. Jour. Sci. Ind. Res. *19B* : 252.

Sanan, S. and Vogt. M. (1962) ... Effect of drugs on the noradrenaline content of brain and peripheral tissues and its significance. Brit. Jour. Pharmacol., *18* : 109.

Sethy, Vimala, H. and Sheth, U. K. (1968) ... Factors affecting barbiturate sleeping time. Ind. Jour. Med. Sc., 22 : 507.

Turner, R. A. (1965) ... Screening methods in pharmacology. 1st ed. Academic Press, New York.

Vacek, L. and Sedlak, B. (1962) ... Comparison of the physical, chemical and biological action of saponins. Gumna. Jour. Med. Sc. 11 : 1.

Winter, C. A. and Flatkar, L. (1952) ... The effect of cortisone, desoxycorticosterone A C T H and Diphenhydramine upon the responses of albino mice to general anaesthetics. Jour. Pharm. and Exp. Therap. *105* : 358.

Yamamoto, I., Kurogochi, Y., Kitamura T., Nishio, H. and Tamori, Y. (1958) ... Effect of nor-nicotine and thiamine on the autonomic ganglia. Jour. Nara. Med. Asson. *9* : 36.

———

हिन्दी सारांश

ब्रह्म मण्डूकी पर भेषजगुण विज्ञानीय अध्ययन

ए० एस० रामास्वामी, एस० एम० पेरियास्वामी एवं एन० बसु

(भेषजगुण विज्ञान विभाग, अखिल भारतीय चिकित्सा विज्ञान संस्थान, नयी दिल्ली–१६)

प्रस्तावना

ब्रह्ममण्डूकी फैलने वाली लता है। भारतवर्ष में दलदल वाले क्षेत्रों में सर्वत्र मिलती है। बहुत से स्नायुविक तथा चर्मरोगों में इसके प्रयोग का उल्लेख है। श्वेतकुष्ठ, पाण्डु, व्रणशोथ, मसूरिका, दमा, मानसिक दुर्बलता, उन्माद आदि में इसका प्रयोग होता है (नादकर्णी, १९५४; चोपड़ा आदि १९५८)। इसके पत्रों को दूध के साथ लेने पर इसे मेध्य प्रभावोत्पादक कहा गया है। आयुर्वेदज्ञों ने इसे रसायन कहा है (मुखर्जी, १९५८, ऐथाल एवं सिरसी १९६१)।

इस औषधि के रासायनिक घटकों पर अनेक वैज्ञानिकों ने कार्य किया है (बसु १९४७; ब्याद्ग आदि १९४९ ए)। हालही में इससे प्राप्त ग्लाइको-साइड का विवेचनात्मक अध्ययन किया गया।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

मैसूर से प्राप्त ब्राह्मी पोलोनस्की (१९५९) आदि के द्वारा अध्ययन की गयी। उन्होंने रवेदार एसियाटिकोसाइड एवं ग्लाइकोसाइड प्राप्त किया जिसका द्रवणांक २३० से २३३ डिग्री सेन्टीग्रेड के बीच है। इसके कार्बोहाइड्रेट भाग में ग्लूकोज और रेमनोज होते हैं (पोलोनस्की १९५९)। एशिया महाद्वीप में पाये जाने वाली इसकी विशेष जाति को लंका तथा भारत से प्राप्त कर भट्टाचार्य एवं लिथगोई न परीक्षण किया था। लंका से प्राप्त होने वाली जाति से तीन ट्राइटरपिन अम्ल जैसे, सैन्टिक, सैन्टोइक और सैन्टेलिक आदि हैं। भारत से प्राप्त जाति द्वारा इण्डो सैन्टोइक एसिड (द्रवणांक २७२ डिग्री) की प्रमाणिकता भट्टाचार्य ने (१९५६) में निर्दर्शित की है।

भारतीय जाति से दो ग्लाइकोसाइड जैसे ब्राह्मोसाइड, ब्राह्मोनोसाइड अभी हाल ही में प्राप्त हुए हैं। उनका जनक ब्राह्मनिक एसिड (द्रवणांक २९३ डिग्री) का रासायनिक सूत्र २,६–हाइड्राक्सी, २३–हाइड्राक्सी मिथिल अर्सोलिक एसिड के रूप म स्थिर किया गया है (रस्तोगी आदि १९६० और बसु एवं रस्तोगी, १९६७)। इसके अतिरिक्त आइसोब्राहमिक अम्ल, बिटोलिक अम्ल तथा अल्प मात्रा में स्टिकमैस्टेराल प्राप्त किया जाता है। प्रस्तुत निवन्ध में ब्राह्मी के ग्लाइकोसाइड के भारतीय चिकित्सा पद्धति में निर्दशित चिकित्सोपयोगिता को ध्यान में रखकर भेषजगुण विज्ञानीय परीक्षण किया गया है।

सामग्री एवं विधि

ब्राह्मी के ग्लाइकोसाइड (ब्राह्मोसाइड और ब्राह्मीनोसाइड) का परिश्रुत जल में जलीय घोल बनाकर निम्नांकित अध्ययन किया गया :—

(क) **संज्ञाहीन**,—विशेष प्रकार के, १०० से १५० ग्राम शारीरिक भार वाले चूहों पर इस जलीय घोल का प्रभाव देखा गया।

(ख) इसके अतिरिक्त संज्ञाहीन खरगोश तथा गिनी पिग के हृदय पर प्रभाव इ० सी० जी० द्वारा लीड सेकेण्ड पर इसका देखा गया।

(ग) संज्ञाहीन चूहों पर २५ प्रतिशत जलीय घोल का (१७५ मि० ग्रा० प्रति १०० ग्रा० भार की मात्रा पर प्रभाव देखा गया)। इसके पूर्व एट्रोपिनाइजेशन के लिए १ मि० ग्रा० एट्रोपीन सल्फेट दिया गया।

(घ) वयस्क, श्वेत चहों पर अनियंत्रित वर्ग के रूप में उनके २० से २५ ग्राम शारीरिक भार पर १०० मि० ग्रा० प्रति किलोग्राम की मात्रा में हेक्साबारबीटोन दिया गया तथा अध्ययन के लिए चुनी गयी औषधि को भिन्न भिन्न मात्राओं में चिकित्सित वर्ग के चूहों के लिए दिया गया। इसी वर्ग को ३० मिनट के अन्तर पर परिश्रुत जल में घोले गये हेक्साबारबीटोन को १०० मि० ग्रा० प्रति किलोग्राम में पर्युदर्या गुहा में अन्तःक्षेपण द्वारा दिया गया।

(ङ) **एम्फेटमीन प्रतिकार**–सफेद नर चूहों (२५ ग्रा० शारीरिक भार) के दो वर्गों में से चिकित्सित वर्ग को औषधि तथा अचिकित्सित वर्ग को सैलाइन पर्युदर्या गुहा में अन्तःक्षेपण विधि द्वारा दिया गया। एक घन्टे के बाद १० मि० ग्रा० प्रति किलोग्राम शारीरिक भार की मात्रा में डी-एम्फेटमीन सूचीभरण विधि द्वारा दिया गया। उनकी प्रेरक (मोटर) शक्ति को एक्टोग्राफ द्वारा देखा गया।

(च) **ट्रीमोरीन पर प्रतिकारक अध्ययन**—वयस्क चूहों को ट्रीमोरीन २० मिलीग्राम प्रति किलोग्राम शारीरिक भार की मात्रा में पर्युदर्या गुहा में अन्तःक्षेपण विधि द्वारा दिया गया। स मात्रा के देने के १५ से ३० मिनट के पश्चात् पैरासिमपेथोमाईमेटिक प्रभाव जैसे कंपकपी, लालास्राव एवं मूत्रस्राव आदि परिलक्षित होने लगे। दूसरे वर्ग के चूहों को इसी प्रकार सर्व प्रथम ५० मि० ग्रा० प्रति कि० ग्रा० शारीरिक भार की मात्रा में ब्राह्मी का ग्लाइकोसाइड दिया गया। इसके १५ मिनट बाद मानकित मात्रा में ट्रिमोरीन दिया गया। तत्पश्चात् कंपकपी की स्थिति को अंकित किया गया (टर्नर १९६५)।

(छ) **तापह्रासक प्रक्रिया**—चूहों का गुदामार्गगत तापमान नैदानिकी थर्मामीटर के द्वारा ३०-३० मिनट

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

के अन्तर पर चार घण्टे तक लिया गया। एक मात्रा के अध्ययन के लिए ६ चूहों के एक वर्ग को लिया गया। अनियंत्रित वर्ग में ६ घन्टे के अध्ययन म यह तापमान ९९ से ९८ ८ डिग्री फारेनहाइट तक पाया गया। सभी जीवों को सामान्य तापक्रम २१ से २२ डिग्री सेन्टीग्रेड के बीच में रखा गया।

(ज) **चूहों में प्रेरक प्रक्रिया**—जैक्कोट्स एक्टोग्राफ पर १२ चूहों में प्रेरक प्रक्रिया का अध्ययन किया गया। इसके लिए चूहों का भार २० से २५ ग्रा० के बीच रखा गया। हर जीव को एक घन्टे के लिए एक माह तक लगातार अनुकूलित (कन्डीशन्ड) किया गया। इसके बाद क्लोरप्रोमाजिन को मानकित मात्रा में दिया गया। इसके बाद ब्राह्मी के ग्लाइकोसाइड को ५० से १०० मिलीग्राम की मात्रा में पर्युदर्या गुहा में अन्तःक्षेपण विधि द्वारा देकर एक्टोग्राफ पर एक घन्टे तक प्रेरक शक्ति का मापन किया गया।

(झ) **अनैच्छिक मांसपेशियों पर प्रभाव**—टर्नर (१९६५) की विधि के आधार पर गिनियापिग और शशक की क्षुद्रांत्र पर ब्राह्मी के ग्लाइकोसाइड का अध्ययन किया गया। एसीटिलकोलीन, हाइड्रोक्लोराइड, हीस्टामीन, सेरोटीनीन और बैरियम क्लोराइड आदि आक्षेपक द्रव्यों की तुलना में आक्षेपह्रासक प्रभाव देखा गया। इसके अतिरिक्त गर्भाशय मांसपेशी के टुकड़ों को जलीय परफ्यूजन द्रव में २९ से ३० डिग्री सेन्टीग्रेड पर रखा गया। इन प्रयोगों के परिणामों को तालिकाओं में निर्दशित किया गया है।

परिणाम

ब्राह्मी से प्राप्त सेपोनीन के द्वारा किये गये भेषजगुण विज्ञानीय अध्ययन से निम्नलिखित निष्कर्ष निकलते हैं ;

(अ) इन सेपोनीन में प्रायोगिक जीवों पर अवसादक गुण पाये गये। जो ट्रन्क्वेलाइजर की तुलना में कम हैं। इसकी तुलना क्लोरप्रोमाजीन और मेप्रोबामेट से की गयी हैं।

(आ) इसकी प्रक्रिया की शृंखला मुख्यतया स्नायु मंडल की क्रिया के कोलीनर्जिक अंश पर है, जिसके गहन अध्ययन के लिए भावी प्रयोग सार्थक होंगे।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4 : 2, 1970.

PHARMACOLOGICAL STUDIES ON THE ROOTS OF ABROMA AUGUSTA LINN. (ULATKAMBAL)

S. K. BHATTACHARYA*, R. LAL**, K. BASU***, AND P. K. DAS****

(From the Department of Pharmacology, College of Medical Sciences and Section of Medicinal Chemistry, Postgraduate Institute of Indian Medicine, Banaras Hindu University, Varanasi)

[Received for publication on June 13, 1969]

Introduction

Abroma augusta Linn. (N.O. Sterculiaceae) is a wild plant growing throughout the hotter parts of the Indo-Gangetic plain. It is also cultivated for its decorative flowers. The plant is known by a variety of names : Hindi and Bengalee—*Ulatkambal, Kumal ;* Tamil—*Sivapputtuti ;* English—*Devil's Cotton.* The root and root bark have been popularly used in the indigenous system of medicine as an emmanogogue, in different types of dysmenorrhea and to regulate menstrual flow (Chopra et al., 1956, 1958 ; Nadkarni, 1954).

The roots have been reported to contain fixed oils, resins, an alkaloid in minute quantities (0.01%) and water soluble bases (0.1%). Fairly large quantities of magnesium salts in combination with hydroxy acids have also been reported (Chopra *et al.*, 1956, 1958 ; Nadkarni, 1954). The alkaloid and water soluble bases have been reported to be pharmacologically inert with no significant action on gastro-intestinal tract, circulation, respiration and uterus, both in *vitro* and *in vivo* (Chopra *et al.*, 1958).

Since the roots of the plant have a popular use in indigenous system of medicine, it was thought worthwhile to reinvestigate it.

I. CHEMICAL STUDIES

The powdered roots of *Abroma augusta* were extracted exhaustively with rectified spirit at room temperature by percolation. The water soluble portion of the extract gave a slight precipitate with ammonium reineckate, indicating the presence of quaternary bases. It also gave positive tests for free sugars but showed the absence of glycosides, as tested by Benedict's solution. The total alcoholic extract on concentration yielded a crystalline mass which was filtered and washed with absolute alcohol repeatedly, giving a white solid residue of inorganic salts. The quaternary basic fraction isolated by the reineckate method from the solution left after separation of inorganic salts, exhibited a number of spots on paper chromatogram when developed with Dragendorff's reagent. Some of the spots were identical with those from authentic samples of choline and betaine hydrochloride.

Pharmacological studies were conducted with the water soluble portion of the rectified spirit extract. The extract showed the presence of potassium in concentration of 3 mg/ml by flame photometry. This concentration was about 10% of the total solid constituents of the extract.

N.B. This work was conducted with grant-in-aid from the Indian Council of Medical Research, New Delhi.

* Research Officer, ** Assistant Research Officer, *** Research Fellow.

***** Professor and Head of the Department of Pharmacology.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

II. PHARMACOLOGICAL STUDIES

Materials and Methods

1. *Smooth muscles*

The effect of the drug was studied in an isolated organ bath, on various smooth muscle preparations *viz.* isolated ileum of rabbit, guinea pig and albino rat, isolated uterus of albino rat and guinea pig (gravid and non-gravid) and isolated tracheal chain of dog. Five to eight experiments were conducted with each tissue.

2. *Frog's rectus abdominis muscle*

The effect of the drug was studied on isolated rectus muscle of frog. Five experiments were conducted.

3. *Frog's heart*

The effect of the drug was studied on perfused frog's heart. Five experiments were conducted.

4. *Anaesthetised dog*

Mongrel dogs of either sex and weighing between 10-15 kg were anaesthetised with pentobarbitone sodium (35 mg/kg I.P.). Carotid blood pressure, heart rate and respiration were recorded. Contractions of intestines and uterus *in situ* were recorded in some experiments using a Cushney's myocardiograph. All drugs were injected intravenously through cannulated femoral vein. Eight experiments were conducted.

5. *Central nervous system*

The drug was tested for anticonvulsant (Metrazol, 70 mg/kg S.C. induced convulsions and electroshock 150 m A for 0.2 sec. convulsions), analgesic (rat tail-hot wire technique), barbiturate (pentobarbitone sodium 30 mg/kg I.P.) hypnosis potentiating effect and for effects on general behaviour patterns in albino rats.

6. *Urinary and faecal output*

The effect of oral administration of the drug on urinary excretion and faecal output was studied in albino rats kept in metabolic cages. Senna (50 mg/kg) and urea (1.0 g/kg) were given orally to serve as controls for faecal and urinary output, respectively.

7. *Toxicity studies*

In all *in vivo* experiments where the animals were not sacrificed, they were put under observation for atleast a week for any lethal or obvious adverse effects of the drug.

In all experiments acetylcholine bromide, choline chloride and potassium chloride were used as controls, along with the drug.

All doses and concentrations of the drug have been expressed in terms of dry weight of the extract.

Results

1. *Smooth muscles*

(*a*) ISOLATED ILEUM

The drug in the concentrations of 1-2 mg/ml gave a spasm on isolated intestines of rabbit, guinea pig and albino rat. The spasm was comparable with spasms induced by acetylcholine (0.05 mcg/ml), choline (0.1-0.2 mg/ml) and potassium chloride (1-2 mg/ml). After atropinization (atropine sulphate, 1 mcg/ml) the spasms induced by acetylcholine and choline were completely blocked, potassium chloride spasm was unaffected, whereas the drug induced spasm was partially antagonised (Fig. 1).

(*b*) ISOLATED UTERUS

The drug in concentrations of 2-4 mg/ml had approximately equi-spasmodic action as that of acetylcholine (0.1-0.2 mcg/ml), choline (1.0-1.5 mg/ ml) and potassium chloride (3-4 mg/ml) on gravid and non-gravid uteri of guinea

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

pig and albino rat. After atropinization, the effects of acetylcholine and choline were completely blocked while the spasms induced by potassium chloride and the drug were not affected (Fig. 2).

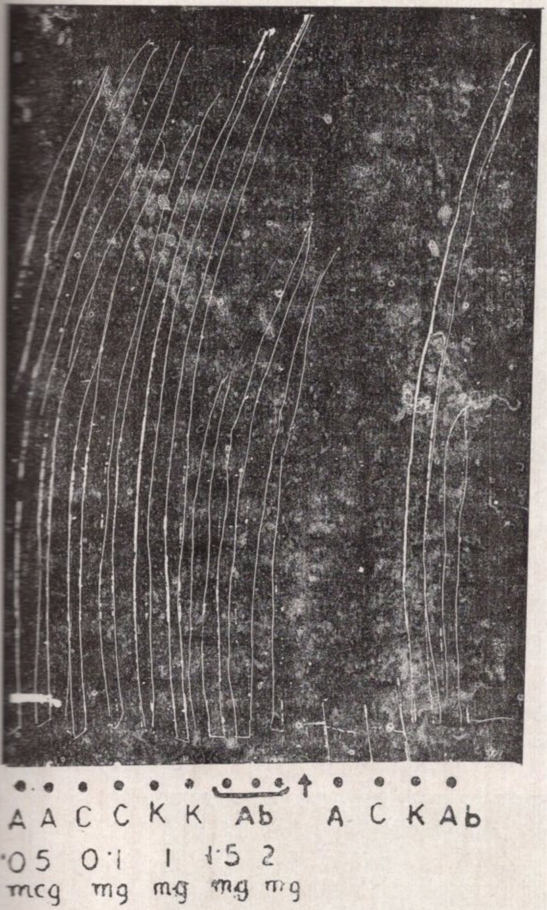


Fig. 1. Effect of *A. augusta* root extract on isolated guinea pig ileum (Ab, 1.5 and and 2.0 mg/ml). Note the spasm induced by the drug. At ↑ atropine sulphate (1 mcg/ml) was added to the bath. After atropinization spasms induced by acetylcholine (A, .05 mcg/ml) and choline (C, 0.1 mg/ml) were completely blocked, potassium chloride (K, 1 mg/ml) spasm was unaffected while drug (Ab) induced spasm was partly blocked.

(c) DOG'S TRACHEAL CHAIN

The drug gave a spasm in the doses of 10 mg/ml which was comparable to the spasms induced by acetylcholine (1 mcg/ml), choline (2.5 mg/ml), and potassium chloride (5 mg/ml). After atropinization the spasms of acetylcholine and choline were completely blocked while the drug induced spasm was partially antagonised and the potassium spasm was unaffected (Fig. 3).

2. *Frog's rectus muscles*

The drug produced a spasm in the doses of 2 mg/ml after curarizing the tissue (d-tubocurarine 5 mcg/ml), spasms of acetylcholine (1 mcg/ml) and choline (0.2 mg/ml) were completely blodcked whereas the drug induced spasm was partially antagonised and that of potassium was unaffected (Fig. 4).

3. *Frog's perfused heart*

The drug in the doses of 20 mg had a marked depressant effect on perfused frog's heart, which stopped in diastole. A similar effect was seen with acetylcholine (0.1 mcg), choline (1 mg) and potassium chloride (10 mg). After atropinization (10 mcg.), the effects of acetylcholine and choline were completely blocked whereas the depressant actions of potassium chloride and the drug were not altered (Fig. 5).

4. *Anaesthetised dog*

The drug upto the doses of 300 to 500 mg/kg intravenously, had no significant effect on the blood pressure, heart rate, respiration, intestinal movements and uterus *in situ* of anaesthetised dog. It also did not modify control responses of adrenaline, acetylcholine, histamine and 5 HT. It was also observed that a similar dose of potassium chloride did not have any significant effect on the above parameters.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

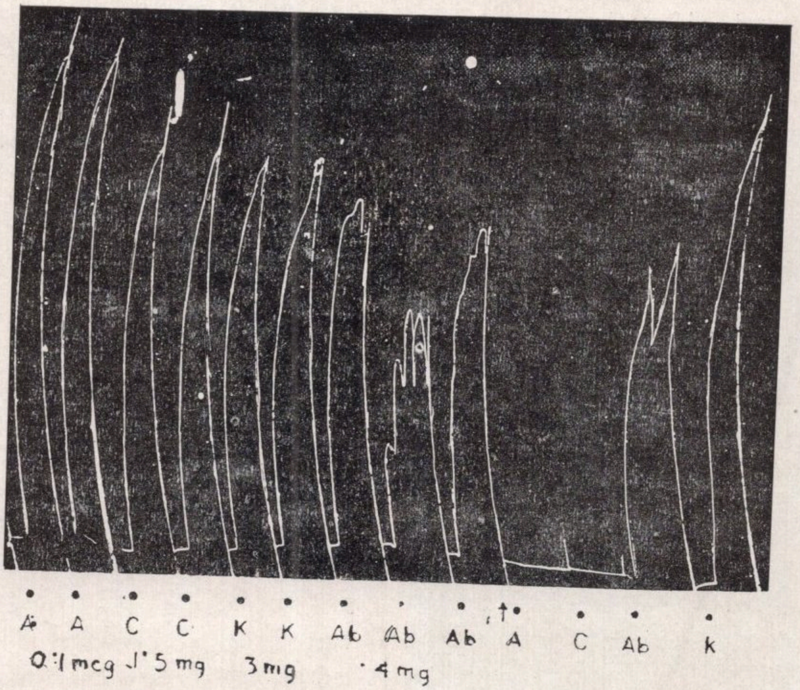


Fig. 2. Effect of *A. augusta* root extract on isolated rat uterus (Ab, 4mg/ml). Note the spasm induced by the drug. At ↑ atropine sulphate (1 mcg/ml) was added to the bath. After atropinization spasms induced by acetylcholine (A, 0.1 mcg/ml) and choline (C, 1.5 mg/ml) were completely blocked whereas potassium chloride (K, 3 mg/ml) and drug induced (Ab) spasms were unaffected.

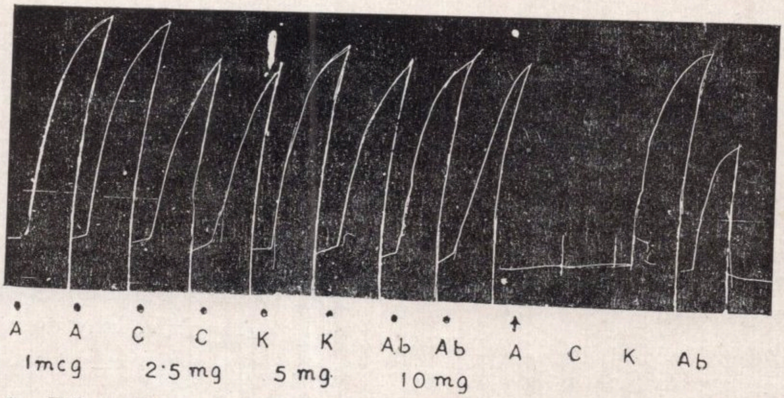


Fig. 3. Effect of *A. augusta* root extract on isolated dog's tracheal chain (Ab, 10 mg/ml). Note the spasm sinduced by the drug. At ↑ atropine sulphate (1 mcg/ml) was added to the bath. After atropinization spasms induced by acetylcholine (A, 1 mcg/ml) and choline (C, 2.5 mg/ml) were completely blocked, potassium chloride spasm (K, 5 mg/ml) was uneffected whereas drug (Ab) induced spasm was partly blocked.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

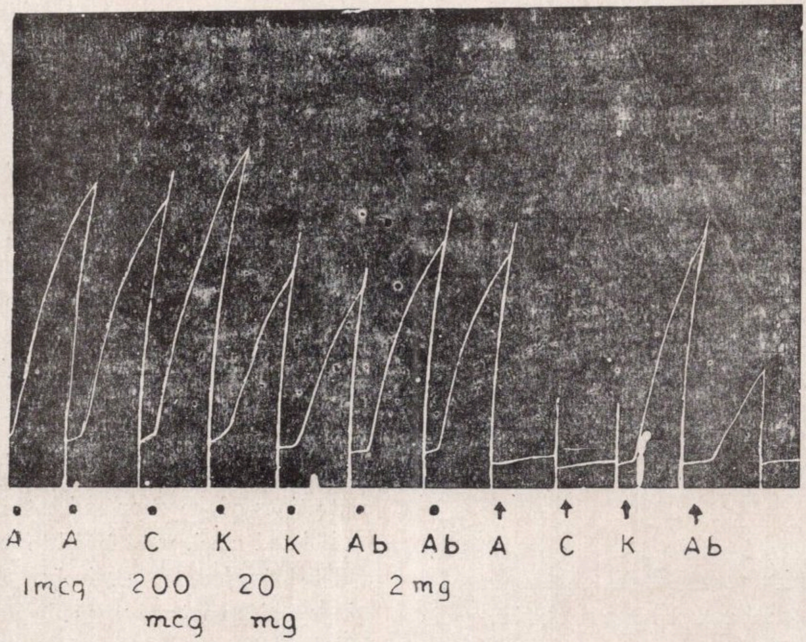


Fig. 4. Effect of *A. augusta* root extract on isolated frog's rectus abdominis muscle (Ab, 2.0 mg/ml). Note the spasm induced by the drug. At ↑ d-tubocurarine (5.0 mcg/ml) was added to the bath. After curarization spasms induced by acetycholine (A, 1.0 mcg/ml) and choline (C, 200 mcg/ml) were completely blocked, potassium chloride spasm (K, 20.0 mg/ml) was unaffected whereas drug induced (Ab) spasm was partially blocked.

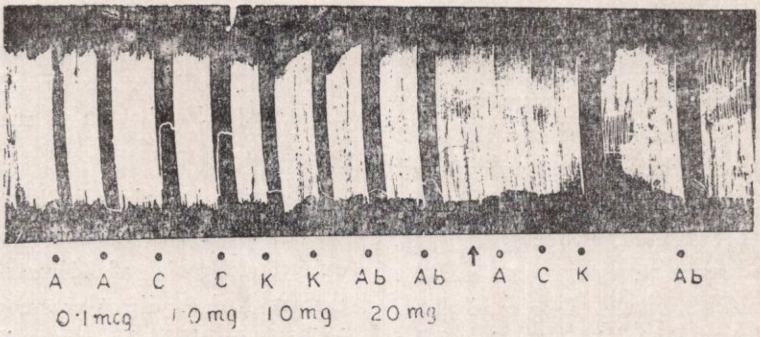


Fig. 5. Effect of *A. augusta* root extract on perfused frog's heart (Ab, 20 mg). Note the marked cardio-depressant effects of the drug, acetylcholine (C, 0.1 mcg), choline (C, 1.0 mg) and potassium chloride (K, 10 mg). At ↑ atropine sulphate (10 mcg) was administered. Note the complete block of acetylcholine and choline effects after atropinization, whereas the effects of potassium chloride and the drug are unaffected.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

5. *Central nervous system*

The drug did not alter the behavioural patterns of albino rats nor did it show any anti-convulsant, analgesic and barbiturate hypnosis potentiating effect, in doses upto 500 mg/kg given orally.

6. *Urinary and faecal output*

The drug did not affect the faecal and urinary excretion in albino rats upto a dose of 500 mg/kg given orally.

7. *Toxicity*

The drug did not produce any obvious toxic effect upto a dose of 500 mg./kg. orally, in albino rats.

Discussion

Phytochemical studies on the roots of *Abroma augusta* showed the presence of inorganic salts, choline, betaine and another unidentified quaternary base. Potassium content of the root extract was 10% of the solid constituents.

The pharmacological studies conducted with the water soluble portion of alcoholic extract showed spasmogenic activity on isolated smooth muscles and skeletal muscle. The spasms were partially antagonised by traditional cholinergic blocking agents on isolated intestine, trachea and skeletal muscle. This suggests that part of the activity is cholinergic in nature and may be due to choline present in the extract. That part of the spasm which is not antagonised by anticholinergic agents is possibly a direct stimulant action mediated, at least in part, through the potassium present in the extract. The spasm induced by the drug on isolated uteri of different species is not affected by atropine, hence this effect may be a predominantly direct one and the cholinergic component may be relatively unimportant here. On the heart, the drug had a direct depressant effect, resembling the action of potassium chloride.

In vivo studies failed to reproduce the *in vitro* effects in the same way as potassium chloride in similar circumstances.

All the pharmacological activities of the extract cannot be attributed to the presence of choline and potassium in the extract, since the concentration of choline and potassium in the extract do not explain the quantitative pharmacological activity of the extract. On analysing the results it becomes evident that the direct action of the drug, which persists after the cholinergic component has been blocked, cannot be due to only potassium present in the extract. The approximate equispasmodic concentrations of the drug and potassium chloride on isolated uteri, were found to be 2-4 mg/ml and 3-4 mg/ml, respectively. The potassium content of the extract was only 10% of the total solid constituents, thus only 0.2-0.4 mg/ml of potassium would be responsible for part of the spasm induced by the drug. The rest of the direct spasmogenic component of the drug would therefore be something else which shows a potassium-like effect on smooth muscles. A similar situation was found with all isolated tissues and perfused frog's heart.

The present findings do not substantiate the popular use of the drug in the indigenous system of medicine since the drug has no significant systemic effect on uterus.

Summary

Pharmacological studies have been conducted on the water soluble fraction of rectified spirit extract of roots of *Abroma augusta*. The extract had a direct spasmogenic effect on isolated gravid and non-gravid uteri, a dual (cholinergic and direct) effect on isolated intestines of rabbit, guinea pig and albino rat, dog's tracheal chain and isolated frog's rectus muscle. It directly depressed the perfused frog's heart. The extract had no significant

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

effect on anaesthetized dog's blood pressure, heart rate, respiration, ileum and uterus. It showed no central nervous system activity, no effect on faecal and urinary output and no obvious toxicity.

The results have been discussed.

REFERENCES

CHOPRA, R. N., CHOPRA, I. C. AND HANDA, K. L. (1958) ... Indigenous Drugs of India, 1st *Ed.* p. 259-260, U. N. Dhur & Co., Calcutta.

CHOPRA, R. N., NAYAR, S. L. AND CHOPRA, I. C. (1956) ... Glossary of Indian Medicinal Plants, p. 1, Council of Scientific and Industrial Research, New Delhi.

NADKARNI, K. M. (1954) ... Indian Medica, 3rd. *Ed.* Vol. 1, p. 4-5, Popular Book Depot, Bombay.

हिन्दी सारांश

उलटकम्बल मूल पर भेषजगुण विज्ञानीय अध्ययन

एस० के० भट्टाचार्य, आर० लाल, के० बसु एवं पी० के० दास

(भेषजगुण विज्ञान विभाग, चिकित्सा विज्ञान महाविद्यालय एवं भेषजीय रसायन शास्त्र उपविभाग, स्नातकोत्तर आयुर्वेदीय संस्थान, काशी हिन्दू विश्वविद्यालय, वाराणसी)

प्रस्तावना

उलटकम्बल एक जंगली पौधे के रूप में भारत के अन्य भागों में मिलता है। इसे शोभा बढ़ाने आदि के कार्यों के लिए भी उगाया जाता है। इसे संस्कृत में पिशाचकार्पास, पीवरी, हिन्दी में उलटकम्बल तथा बंगला में ओलटकम्वल या कुमाल, तमिल में शिवपुट्टूटी तथा आंग्ल भाषा में डेविल्स काटन कहते हैं। इसकी जड़ें तथा जड़ों की छाल को भारतीय चिकित्सा पद्धति में आर्तवोत्सारक तथा विभिन्न प्रकार के कृच्छार्तव के शमन तथा ऋतुकाल की अनियमितताओं के लिए प्रयोग में लाते हैं–(चोपड़ा आदि १९५६, १९५८ और नादकर्णी १९५४)। इसके मूल में तैलांश, रेजीन्स और सूक्ष्म मात्रा में (०.०१%) सक्रिय तत्व मिलते हैं। जल में घुलनशील भाग भी ०.१% होताहै। मैग्नेशियम के लवण हाइड्राक्सी एसिड के संयोग के साथ अधिक मात्रा में पाये जाते हैं (चोपड़ा आदि १९५६, १९५८ और नादकर्णी १९५४)। इसमें प्राप्त सक्रिय तत्व तथा जल में घुलनशील भाग को भेषजगुण विज्ञानीय अध्ययन के आधार पर निष्क्रिय माना गया है। क्योंकि इसका आमाशय, आंत्रगत-मार्ग, रक्त परिभ्रमण, श्वाँस क्रिया तथा गर्भाशय पर इनभिट्रो और इनवाइवो दोनों ही अवस्थाओं में कोई प्रभाव नहीं पाया गया (चोपड़ा आदि १९५८)।

रासायनिक अध्ययन

एब्रोमा एगस्टा अथवा उलटकम्बल की जड़ों का चूर्ण बनाकर, सामान्य तापक्रम पर स्पिरिट मे रखकर निच्यन किया गया। इससे प्राप्त सारतत्व का जल में घुलनशील भाग को अमोनियम रिनेकेट के साथ श्वेत प्रच्छेप

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

मिला, जिससे क्वार्टेनरी बेसेज के होने का संकेत मिलता है। बेनेडिक्स घोल की परीक्षा से इसमें शर्करा होने का प्रमाण मिलता है। लेकिन ग्लाइकोसाइड अनुपस्थित पाये गये। इसके अल्कोहलीय सारतत्व के संघनन से रवेदार पदार्थ मिला, जिसे विशुद्ध अल्कोहल से कई बार छाना और साफ किया गया। इसी में श्वेत ठोस अकार्बनिक लवण के प्रक्षेप पाये गये। अकार्बनिक लवण से युक्त होने पर पेपर क्रोमैटोग्राम पर क्वार्टेनरी बेसेज वाले भाग से प्राप्त धब्बों की तुलना कोलीन और बीटेन हाइड्रोक्लोराइड से की जा सकती है।

भेषजगुण विज्ञानीय अध्ययन रेक्टीफाइड स्पिरिट से प्राप्त सत्व के जल में घुलनशील अंश पर किया गया। इसमें फ्लेम फोटोमीटरी के आधार पर ३ मि० ग्रा० प्रति मि० ली० की मात्रा में पोटेशियम की उपस्थिति मापी गयी। यह अंश सत्व के पूरे ठोस भाग का दशांश रहा।

सामग्री और विधि

(क) **अनैच्छिक मांसपेशियां**:—इस प्रयोग में 'आर्गन बाथ' पर अनेक प्रकार की अनैच्छिक मासपेशियाँ जैसे शशक, गिनियापिग और सफेद चूहे के क्षुद्रान्त्र, श्वेत चूहे और गिनियापिग के गर्भाशय पर तथा कुत्ते की श्वास नलिका पर औषधि का प्रभाव १ से २ मि० ग्रा० प्रति सी-सी, २ से ४ और १० मि० ग्रा० की मात्रा में ५ से ८ प्रयोगों तक अध्ययन किया गया। इसका तुलनात्मक अध्ययन एस्टीलकोलीन, कोलीन और पोटैशियम क्लोराइड से किया गया। तत्पश्चात् एट्रोपीन सल्फेट (१ माइक्रोग्राम/मि० ली०) से एट्रोपनाइज्ड करके भी देखा गया है।

(ख) **मेंढक की रेक्टस एब्डामनिस मांसपेशी**:— इसके लिए मेंढक की रेक्टस एब्डामनिस मांसपेशी को निकालकर ५ प्रयोग किये गये। इस औषधि को २ मि० ग्रा०/मि० ली० की मात्रा में दिया गया। इन कोशाओं को डीट्यूबोकुरेरीन से क्वेरेराइज किया गया। तदनन्तर एस्टीलकोलीन, कोलीन, पोटेशियम तथा औषधि के प्रभाव को देखा गया।

(ग) **मेंढक के हृदय पर प्रभाव**: इस प्रयोग के लिए २० मि० ग्रा० की मात्रा में औषधि का द्रव निवेशन (परफ्यूजन) किया गया तथा इसका तुलनात्मक अध्ययन भी किया गया।

(घ) **संज्ञाहीन कुत्तों पर प्रभाव**: १० से १५ किलोग्राम शारीरिक भार वाले कुत्तों को संज्ञाहीन (३५ मि० ग्रा०/कि० ग्रा० की मात्रा में पर्युदर्या गुहा में निम्बूटाल अन्तःक्षेपण विधि द्वारा) किया गया। कैराटिड रक्तचाप, हृदय गति, श्वास प्रक्रिया पर इसकी प्रभाव देखा गया। आंत्र और गर्भाशय पर भी प्रभाव देखा गया तथा। फिमोरलशिरा द्वारा औषधि दी गयी। ऐसे आठ प्रयोग किये गये।

(ङ) **केन्द्रीय स्नायुमंडल पर प्रभाव**: इस औषधि के आक्षेप ह्रासक गुण को मेट्राजाल (७० मि० ग्रा०/कि० ग्रा० एस० सी० प्रेरित आक्षेप) और विद्युतीय क्षोभण द्वारा (१५० एमपीयर्स) तथा पीड़ाहर प्रयोग 'रैट टेल हाट वायर' विधि तथा बारबीचुरेट (पेन्टा बारबीचुरेट सोडियम ३० मि० ग्रा०/कि० ग्रा० की मात्रा में पर्युदर्यागुहा अन्तःक्षेपण विधि द्वारा) देकर किया गया। इन सबका प्रभाव उनके सामान्य व्यवहार पर देखा गया।

(च) **मल-मूत्र पर प्रभाव**: मेटाबोलिक केजेज में रखे चिकित्सित वर्ग के श्वेत चूहों के मल एवं मूत्र के परित्याग की मात्रा को मुख द्वारा दी गई औषधि की तुलना में देखा गया। सनाय (५० मि० ग्रा०/कि० ग्रा०) तथा यूरिया (१.० मि० ग्रा०/कि० ग्रा०) का भी प्रभाव अचिकित्सित वर्ग के चूहों पर मुख द्वारा देकर देखा गया।

(छ) **विषाक्तता पर अध्ययन**: इन जीवों को १ सप्ताह परीक्षण में रखकर औषधि के विषाक्त गुणों का प्रभाव देखा गया। इस प्रयोग के साथ ही साथ ऐसिटिलकोलीन, ब्रोमाइड, कोलीन, क्लोराइड और पोटैशियम क्लोराइड का तुलनात्मक अध्ययन भी किया गया। इस प्रयोग में ५०० मि० ग्रा०/कि० ग्रा० तक औषधि देकर देखा गया, कोई विषाक्त प्रभाव नहीं रहा।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

परिणाम

उलटकम्बल मूल के संशोधित प्रासवसार के जल में घुलनशील भागांश के भेषजगुणविज्ञान विषयक अध्ययन का विवरण इस शोध निबन्ध में दिया गया है। औषधि का पृथक्कारित सगर्भा एवं अगर्भा गर्भाशय पर प्रत्यक्ष आक्षेपक प्रभाव; शशक, वण्टमूस और श्वेत चूहे के पृथक्कारित आंत्र पर, कुत्ते की श्वांसनालिका मांसपेशी पर एवं मण्डूक के पृथक्कारित ऋजु पेशी पर द्विमुखी (कोलीनर्जिक तथा प्रत्यक्ष) प्रभाव पाया गया। इसने मंडूक के पारव्यामित हृदय को प्रत्यक्ष रूप से अवसादित किया। औषधि का अचेतनीकृत कुत्ते के रक्तचाप पर हृद्प्रत्यंक, श्वास-प्रश्वास क्रिया, आंत्र एवं गर्भाशय पर कोई प्रभाव नहीं पाया गया। इसका केन्द्रीय स्नायु प्रणाली तथा मल मूत्र निष्कृति पर कोई प्रभाव नहीं पाया गया।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4 : 2, 1970.

PHYTOCHEMICAL AND PHARMACOLOGICAL INVESTIGATIONS OF ANCHUSA STRIGOSA (GAOZBAN), AN INDIAN MEDICINAL PLANT.

B. D. GARG*, S. K. GUPTA**, N. R. KRISHNASWAMY*** AND R. B. ARORA****

(*Department of Pharmacology, All India Institute of Medical Sciences, Ansari Nagar, New Delhi-16*).

[Received for publication on February 10, 1969]

Introduction

The plant *Gaozban* has been used since antiquity for treatment of asthma, stones in bladder and kidney, in complaints of black bile, as a stimulant, tonic, diuretic, laxative, demulcent and antitussive (Chopra, 1933, 1956). Despite its reported repute and supposed value, not much of authentic experimental evidence about its clinical and pharmacological properties is available. The name *Gaozban* has been given to many different plants of the family Boraginaceae namely *Anchusa strigosa*, *Caccinea glauca*, *Onosma bracteatum*, *Trichodesma zeylanicum* and *Macrotomia banthemi*. Quardry and Hamid (1962) have reported on the basis of pharmacognostic studies on these different species that *Anchusa strigosa* is the only genuine variety which is known as *Goazban*.

Preliminary studies on partially purified extract of *Onosma bracteatum* leaves (*Gaozban*) were reported by Arora and Dandiya (1957). Arora and Arora (1962) reported the diuretic activity of the glycosides of *Caccinea glauca*, a plant known by the same name *Gaozban*. Basu Ray (1967) studied the pharmacology of a saponin isolated from *Caccinea glauca* and reported a mild to moderate degree of hypotensive activity on various species of animals. The present investigation has been carried out with a view to determine the chemical and pharmacological properties of the flowers of the plant *Anchusa strigosa*.

Materials and Methods

CHEMICAL INVESTIGATION

Flowers of *Anchusa strigosa* were procured from Institute of History of Medicine and Medical Research, Delhi and were subjected to the following extraction procedure.

The air dried powdered flowers were exhaustively extracted in a soxhlet apparatus with petroleum ether (60-80°), ether, alcohol (90%) and finally with water, solvents were removed under reduced pressure and the extracts were dried in a vacuum desiccator to constant weight. The preliminary pharmacological experiments showed that the activity lay mainly in the alcoholic and the aqueous extracts whereas the petroleum ether and other extracts were devoid of such activity. The aqueous extract was much more active than the alcoholic extract and it produced hypotension for a considerable period when injected I/V in cats and dogs.

* Assistant Professor, Deptt. of Pharmacology, Punjab Agricultural University, Hissar.

** Research Officer (ICMR) Deptt. of Pharmacology, AIIMS, New Delhi.

*** Reader in Chemistry, Central College, Bangalore.

**** Prof. & Head, Deptt. of Pharmacology, AIIMS, New Delhi.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Therefore this extract was taken up for further examination of its chemical compounds with a view to isolate the active principle.

Preliminary colour tests *e.g.* Molisch test for free sugars, Liebermann Burchard test for steroids and triterpens, Mayer's reagent for alkaloids, were performed to know the nature of the active principle peresent. As the extract showed the presence of glycosides, an attempt was made to further purify it according to the method of Tracey and Peach (1955).

In order to remove any polyphenolic impurities the extract was first treated with neutral lead acetate, when a lead salt precipitated and was rejected. The filtrate was subsequently treated with basic lead acetate which also formed a precipitate. This was also filtered off and the filtrate treated with hydrogen sulphide gas to remove any excess lead acetate in solution. The filtrate was concentrated and dried. The residue was taken up for further studies. The crude aqueous extract was hydrolysed with 7% sulphuric acid for 2 hours and the hydrolysate was examined for sugars by paper chromatography. The following irrigating solvent systems were employed and the papers were sprayed with aniline hydrogen phthalate (Patridge, 1949).

(1) n-Butanol : Acetic acid : Water (4:1:5 V/V)
(2) n-Butanol : Acetone : Water (2:7:1 V/V)
(3) n-Butanol : Pyridine : Water (6:4:2 V/V)

PHARMACOLOGICAL INVESTIGATIONS

The hypotensive activity of the glycoside fraction from *Anchusa strigosa* was evaluated by the cardiovascular studies in the anaesthetized dogs, cats, rats, spinal cats, and in isolated preparations. The anaesthetic agents as well as the weight dose relationship of the test drug in each class of animals are given below :

Animals	*No. of Expts.*	*Anaesthetic agent*	*Wt./Dose relationship*
1. Dogs (7-11-kg)	6	Pentobarbitone sodium. 35 mg/kg (I/P)	5-100 mg/kg
2. Cats (2-3 kg)	3	Chloralose 80 mg/kg (I/V)	40-80 mg/kg
3. Rats (170-250 g)	5	Urethane 25% solution (0.6 ml/100 gm (I/P)	1-5 mg/kg
4. Spinal cats (2-3 kg)	2	Chloralose 80 mg/kg (I/V)	40-80 mg/kg

In addition, changes brought about by this drug on some fundamental properties of the cardiac muscle were also examined on the isolated rabbit heart (Langendorff's preparation as described by Burn 1962), isolated rabbit's auricles (Burn 1952), Straub's frog heart preparation (Sollman, 1917) and on the atrioventricular nodal rhythm on isolated perfused rabbit heart (Benforado, 1958). The drug action was also studied in cats in relation to carotid baroreceptor reflex, vagal blockade, vagotomy, adrenergic blockade. Electrocardiographic studies were done in cats administered with the drug. Acute toxicity studies were performed in male albino mice by using Litchfield and Wilcoxon method (1949) of finding out LD-50, male albino mice weighing between 20-30 gm were used. The drug in doses of 100 mg, 200 mg, 1 g, 1.5 g, 2 g and 4 g/kg I/P was injected respectively in 6 groups of total 80 mice, 7th group was kept as control.

Observations

Preliminary colour tests indicated the presence of sugars and of glycosides as shown by positive Molisch test and Benidict test was positive for free reducing sugars. It also responded to the Liebermann Buchard colour test

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

indicating the presence of steroid or triterpene like compounds. The paper chromatograms indicated the presence of three sugars which had the same R_f values as authentic samples of glucose, rhamnose and ribose.

PHARMACOLOGICAL RESULTS

1. *Action on Blood Pressure*

When the glycoside was administered in dogs in a dose of 20 mg/kg there was on the average a fall of 20% of the original which returned to the same level within 1-2 minutes. In the dose of 40 mg/kg the fall was 32 percent which returned to the original level within 1 hour. A dose of 80 mg/kg showed a fall of 55 percent which took 2-3 hours to normalise.

In cats the effects of the glycoside on the blood pressure were more or less similar to that of dogs. The higher dose (80 mg/kg) showed more pronounced effect with respect to magnitude and duration of blood pressure fall as compared to lower dose.

In rats, the hypotensive effect lasted for 1-3 minutes with low dose of glycoside (1-2 mg/kg) while with high dose (5 mg/kg) the average duration of action was 1.5 hours.

No modification of hypotensive action in respect of magnitude and duration of fall was found in spinal-cat preparations compared to intact animals when the glycoside was administered (40 and 80 mg/kg).

2. *Electrocardiographic Studies*

In a dose of 40 mg/kg I/V in cats, the glycoside caused a prolongation of P-R interval and a slight depression of T wave in the bipolar limb lead II. In 80 mg/kg I/V dose, there was inversion of T wave and depression of S-T segment.

3. *Effect on the Carotid Baroreceptor Reflex*

During the hypotension produced by the glycoside in doses of 40-80 mg/kg in cats a rise in blood pressure due to simultaneous occlusion of both carotid arteries was not manifested as seen before administration of the drug.

4. *Effect on Vagal Blockade*

The hypotensive effect of the glycoside was tested to see if it was atropine sensitive. It was observed that atropine pretreatment in cats in a dose of 2 mg/kg I/V could effectively block the hypotensive effect of the drug (Fig. 1).

5. *Effect of Vagotomy*

Severing both the vagii before the administration of the glycoside in a dose of 40 mg/kg and 80 mg/kg resulted in the blockade of hypotensive effect of the glycoside on cats' arterial blood pressure.

6. *Effect of Adrenergic Blockade*

Pretreatment of dihydroergotamine, 1 mg/kg, I/V, to chloralose anaesthetized cats did not manifest any change in the hypotensive effect of the glycoside.

ACTION ON THE ISOLATED TISSUE PREPARATION

1. *Isolated Mammalian Heart*

Perfusion of the glycoside on isolated heart revealed that in doses of 2 to 5 mg there was a marked reduction in the amplitude of contraction. But in lower doses (0.1-0.2 mg), positive ionotropic effect was observed. The coronary outflow was reduced in higher concentration of the drug (Fig. 2).

2. *Isolated Rabbit Auricle*

Effect of the glycoside on this preparation was found to be similar to those observed on the perfused rabbit heart. There was a slight increase in the amplitude of contraction in doses of 0.01 to 0.1 mg. In doses of 2 mg and above, the amplitude of auricular contraction was decreased. A small reduction in the heart rate was also observed at all dose levels.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

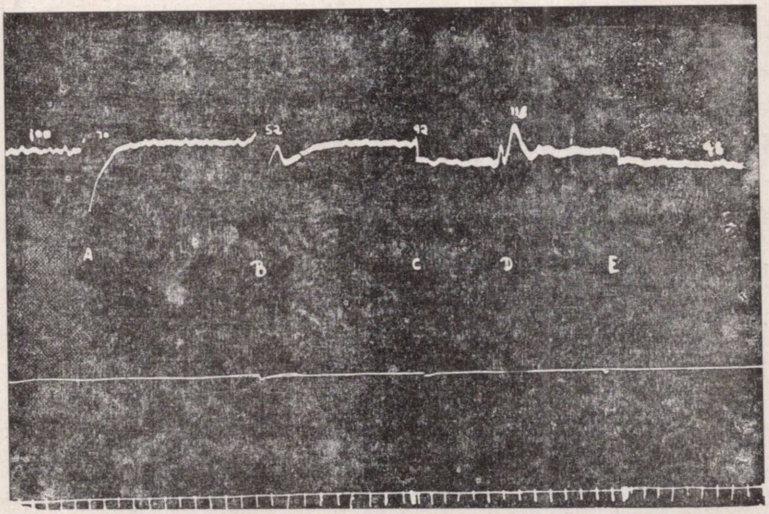


Fig. 1. Showing the effect of the glycoside on the blood pressure and heart rate per minute of cat. At A and E 20 mg/kg of the glycoside, at B and D acetylcholine 1 μg/kg and at Catropine sulphate 2 mg/kg, were injected intravenously.

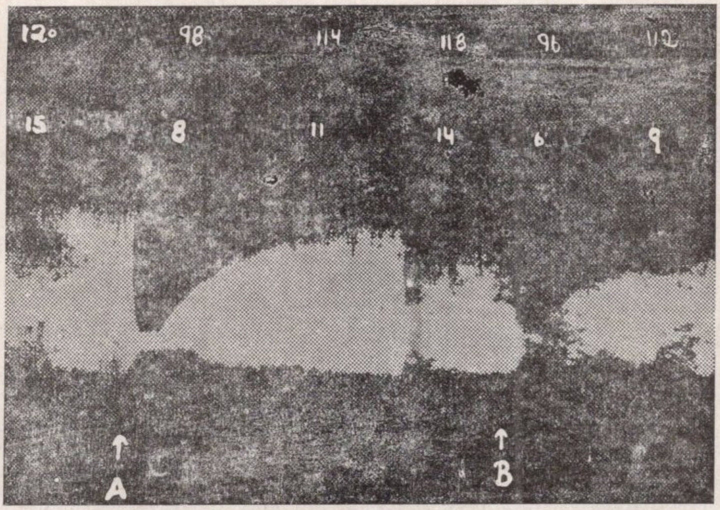


Fig. 2. Showing the effect of the glycoside on the isolated perfused rabbit heart. From above downwards—heart rate per, minute, out flow fluid volume per minute and contractions of the heart. At A and B the glycoside was injected in doses of 2 and 5 mg respectively.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

3. *Effect on A. V. Nodal Rhythm*

In lower doses, it was devoid of stimulating effect on the amplitude of ventricular contraction. Negative inotropic action was manifested at all doses levels. In all the doses, the drug depressed the A. V. nodal rhythm.

4. *Effect on the Isolated Frog Heart*

The effect of the glycoside on the heart rate and ventricular contraction was observed in doses of 0.01 to 0.1 mg. In smaller doses, there was a decrease in the amplitude of ventricular contraction. Higher doses were found to produce cardiac arrest.

DETERMINATION OF LD_{50} IN MICE

Plotting log dose against percentage mortality on a probit paper, LD-50 was found to be 2080 mg/kg (I/P). The confidence limit calculated are 1965-2195 mg/kg.

Discussion

The semipurified aqueous extract of *Anchusa strigosa* answered the Molisch test as well as the Benidict test for free reducing sugars. It also responded the Liebermann Buchard colour test indicating the presence of steroid or triterpene like compounds. Since the material was completely soluble in water and no portion of it could be removed by treatment with organic solvents like ether or benzene, it appeared that the steroid or triterpene was present as glycoside administered with free sugars. This was also supported by the observation that when the material was heated with 7% sulphuric acid as in a typical hydrolysis experiment, a product insoluble in water was separated. This substance answered the Liebermann Buchard test and obviously was liberated as a result of hydrolysis. The paper chromatographic results revealed the presence of glucose and also probably ribose and rhamnose as the sugars or the sugar moeity of the glycoside.

The pharmacological studies revealed that the glycoside possessed a moderate to marked hypotensive action in dogs, cats and rats. The experiments on the spinal cat showed that the hypotensive effect was not due to a central effect. The carotid baroreceptor reflex was found to be depressed during hypotension though this indicates an adrenergic blocking effect. Another observation that the glycoside fails to exert its action on previously atropinised or vagotomised animals explains that the action is probably mediated, at least partly, through the parasympathetic system. However, the glycoside was not found to exert any nicotine like action like acetylcholine. Therefore it is assumed that its action is mainly muscarinic type on the blood pressure. The other factor which may contribute to the hypotensive action is the negative inotropic effect as the glycoside produced predominently depressant effect on the isolated heart preparations.

Further chemical and pharmacological studies of the plant are in progress.

Summary

1. Phytochemical and pharmacological studies have been done with the flowers of a plant Anchusa strigosa (Gaozban).

2. From the aqueous extract of the plant a semipurified glycoside has been obtained.

3. The pharmacological studies with this glycoside shows that it possesses mild to moderate degree of hypotensive effect.

4. A probable mode of action of this glycoside has been discussed.

ACKNOWLEDGMENT

The authors gratefully acknowledge the financial assistance rendered by I.A.R.I. and C.S.I.R. The authors wish to thank the Director, A.I.I.M.S., New Delhi-16 for the facilities provided to work. Part of this work was submitted as a thesis by one of us (B.D. Garg).

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

REFERENCES

ARORA, R. B. AND ARORA, H. R. K. (1962) ... Pharmacological investigation of the glucoside and a glucone isolated from Caccinea glauca J. Pharmaceutical Sci. 51 : 104.

ARORA, R. B. AND DANDIYA, P. C. (1957) ... A phytochemical and Pharmacological study of Onosma bracteatum Wall. J. Am. Pharm. Assoc. 46 : 111.

BASU RAY, B. (1967) ... Pharmacological studies of a saponin from Caccinea glauca. M. D. Thesis submitted to the faculty of A.I.I.M.S.

BENFORADO, J. M. (1958) ... A depresant effect of acetylcholine on the idiventricular pace maker of the isolated rabbit heart. Brit. J. Phavmacol. 13 : 415.

BURN, J. H. (1952) ... Practical pharmacology, 1st ed. p. 25-26. Blackwell, London.

BURN, J. H. (1952) ... Practical pharmacology, 1st ed. p. 22-24. Blackwell, London.

CHOPRA, R. N. (1933) ... Indigenous drugs of India, 2nd ed. p. 517, 598, 680. Art Press. Calcutta (India)

CHOPRA, R. N., NAYAR, S. L. AND CHOPRA I. C. (1956) ... Glossary of Indian Medicinal Plants, p. 180, 43, 59. Council of Scientific and Industrial Research, New Delhi.

LITCHFIELD, J. T. AND WILCOXON, F. (1949) ... A simplified method of evaluating dose effect experiments. J. Pharmacol. Exper. Therap. 96 : 99.

PATRIDGE, S. M. (1949) ... Aniline hydrogen phthalate as a spraying reagent for chromatography of sugars. Nature 164 :443.

QUADRY, S. M. J. S. AND HAMID ABDUL (1962) ... Botanical identification of Gaozban. J. Sci. Ind. Res. 21C, 317-320.

SOLLMAN, T. (1917) ... A laboratory guide in Pharmacology 1st. Ed. p. 191. W.B. Saunders, Phildelphia.

TRACEY, M. V. AND PEACH, M. (1955) ... Modern methods of plant analysis, 4th Volume 464-466 Springu Verlag, Berlin.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

हिन्दी सारांश

एन्चूजा स्ट्रीगोसा (गाजबाँ या गोजिह्वा), एक भारतीय चिकित्सोपयोगी पौधे का पादपानुवंशीय एवं भेषजगुण विज्ञानीय परीक्षण।

बी॰ डी॰ गर्ग, एस॰ के॰ गुप्त, एन॰ आर॰ कृष्णस्वामी एवं आर॰ बी॰ अरोड़ा

(भेषजगुण विज्ञान विभाग, आल इण्डिया इन्सटीच्यूट आफ मेडिकल साइन्सेज, अन्सारी नगर, नई दिल्ली–१६)

प्रस्तावना

प्राचीन काल से गाजबाँ का प्रयोग दमा, वृक्क एवं वस्तिगत अश्मरी के विनाश, पित्ताशयगत पित्त के ह्रास के लिए, बल्य, मूत्रल, मलनिस्सारक, उपशमक, श्वाँस कास शामक आदि रूपों में होता आ रहा है (चोपड़ा, १९३३, १९५६)। इसको व्यापक चिकित्सोपयोगिता की तुलना में विश्वसनीय परीक्षणों का अभाव ही है। गाजबाँ के नामसे बोरेजिनेसी फैमिली (श्लेषमातक कुल) के अनेक पौधे जैसे कैसीनिया ग्लोका, ओनोसमा ब्राक्टियाटम, त्रिकोडेसमा जेलानिकम और मैक्रोटोमिया बेन्थेमी को भी गाजबाँ के नामसे पुकारा जाता है। कादरी एवं हमीद (१९६२) ने एन्चूसा स्ट्रीगोसा को अपने औषधि प्रकृति विज्ञानीय अध्ययन के आधार पर गाजवाँ के नाम से ली जाने वाली औषधियों में सर्वोत्तम माना है।

लेखक ने ओनोसमा ब्राक्टियाटम पत्र से प्राप्त विशुद्ध सारतत्वों पर प्रारम्भिक अध्ययन किया था (अरोड़ा एवं दाण्डीया १९५७)। अरोड़ा आदि ने १९६२ में कैसीनिया ग्लोका से प्राप्त ग्लाइकोसाइड के मूत्रल प्रभाव को गाजबाँ के नाम से प्रस्तुत किया था। बसु (१९६७) ने इस पौधे से प्राप्त सैपोनिन में कई प्रकार के जीवों में सामान्य से ऊपर स्थिति का रक्तचाप ह्रासक प्रभाव बतलाया है। प्रस्तुत अध्ययन में एन्चूसा स्ट्रीगोसा (गाजबाँ) के पुष्पों में विद्यमान भेषजगुण विज्ञानीय एवं रासायनिक गुणों का विवेचन किया गया है।

सामग्री एवं विधि

रासायनिक परीक्षण :—गाजबाँ के पुष्पों को इस अध्ययन के लिये 'इन्स्टीच्यूट आफ हिस्ट्री आफ मेडिसिन एण्ड मेडिकल रिसर्च, नयी दिल्ली' से प्राप्त किया गया। पुष्प चूर्ण का साक्सलेट यंत्र की सहायता से पेट्रोलियम ईथर (६० से ८० डिग्री सेन्टीग्रेड), ईथर अल्कोहल (९०%) एवं अन्त में जल से सारतत्व प्राप्त किया गया। डेसीकेटेर की सहायता से उन्हें सुखाया गया। प्रारम्भिक भेषजगुण विज्ञानीय प्रयोगों से ऐसा ज्ञात हुआ कि अल्कोहलीय एवं जलीय सारतत्व में मुख्यतःगुण विद्यमान है जब कि पेट्रोलियम ईथर अ वा अन्य प्रकार के सारतत्वों में इनका सर्वथा अभाव था। जलीय सारतत्व, अल्कोहलीय सारतत्व की तुलना में अधिक प्रभावकर था जैसाकि बिल्ली एवं कुत्ते में शिरागत अन्तःक्षेपण द्वारा रक्तचाप ह्रासक गुणों की तुलना में देखा गया। इसीलिए जलीय सारतत्व को अग्रिम रासायनिक परीक्षणों के आधार पर सक्रिय सारतत्व के प्राप्त करने के लिए चुना गया। प्रारम्भ में मोलिस्टेस्ट शर्कराके लिए, लीवरमैन बरचार्ड टेस्ट, स्टीरायड्स एवं ट्राइटरपेन्स तथा सक्रिय सारतत्व के लिए, मेयर्स रीएजेन्ट टेस्ट किया गया। ग्लाइकोसाइड की उपस्थिति का आभास होने पर उसकी शुद्धि के लिए ट्रेसी एवं पीक (१९५५) की विधि का अनुसरण किया गया। सारतत्व की शुद्धता के लिए अन्य सामान्य विधियों का उपयोग किया गया।

भेषजगुण विज्ञानीय अध्ययन

इसके ग्लाइकोसाइड वाले भाग में उपस्थित रक्त-चापह्रासक प्रभाव को मूर्छित कुत्ते, बिल्ली, चूहे, स्पाइनल बिल्लियां तथा अन्य आइसोलेटेड (पृथक्कृत) 'प्रीपरेशन्स' के आधार पर रक्त परिभ्रमण संस्थान पर विशेष मात्रा एवं शारीरिक भार के परस्पर सम्बन्ध को ध्यान में रखकर किया गया। इसके अतिरिक्त

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

हृदय की मांसपेशियो पर विशेषकर शशकों, शशक के अलिन्दो पर, स्ट्राप्स मेंढक के हृदय पर, एण्ट्रियों वेन्ट्रीक्यूलर नोडल गति पर तथा शशक के हृदय आदि पर प्रभाव देखा गया। औषधि का प्रभाव बिल्लियों में कैरोटिड बैरोरिसेप्टर, बेगल ब्लोकेड, बेगोटामी, एडीनरजिक ब्लोकेड आदि पर देखा गया। इलेक्ट्रियो कारडियोग्राफिक परीक्षण भी किये गये। इसकी विषाक्तता का अध्ययन श्वेत चूहों में तथा चूहियों में किया गया।

परिणाम

इससे स्पष्ट होता है कि गाजबाँ से प्राप्त ग्लाइकोसाइड में कुत्तों, बिल्लियों और चूहों में सामान्य से उपर श्रेणी का रक्तचाप ह्रासक प्रभाव है। स्पाइनल बिल्ली पर किये गये प्रयोग से यह स्पष्ट होता है कि रक्तचाप ह्रासक गुण केन्द्रीय स्नायुगत नहीं है। रक्तचापह्रासक स्थिति में 'कैराटिड बैरोरीसेप्टर रिफ्लेक्स' पर इसका अवसादक गुण है, जिससे इसके एडनरजिक ब्लाकिंग गुण का पता लगता है। एट्रोपिनाइज्ड अथवा बेगोटोमाइज्ड जीवों में ग्लाइकोसाइड का कोई प्रभाव न होने से ऐसा पता लगता है कि इसका गुण अल्पांश में ही सही पैरासिमपेथेटिक स्नायु संस्थान द्वारा होता है। एस्टोलकोलीन की तरह नीकोटीन सदृश गुण इसमें नहीं है। अतः रक्तचाप पर मैसकेरेनिक ढग का कार्य करता है। पृथक्कृत हृदय के प्रयोगों पर ग्लाइकोसाइड का अवसादक प्रभाव इसके नकारात्मक आइनोट्रापिक प्रभाव की ओर इंगित करता है, जिससे इसके रक्तचाप ह्रासक होने की ही पूष्टि होती है।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4 : 2, 1970.

PHARMACOGNOSTICAL STUDIES ON ROOTS OF TRIBULUS TERRESTRIS LINN. (GOKHRU MOOL)

M. S. ANSARI* AND S. PRASAD**

(*From the Department of Pharmaceutics, Institute of Technology, Banaras Hindu University*)

[Received for publication on February 22, 1969]

Introduction

The root of *Tribulus terrestris* Linn. (Fam.- Zygophyllaceae) is regarded as one of the ingredients of the famous Ayurvedic preparation *Dashmula*. The plant is an annual, rarely, perennial, prostrate herb with slender spreading branches. It grows throughout India, up to 1100 ft. in Kashmir and Western Tibet and is also found in other warm countries such as Ceylon. The plant is a common weed of the pasture land, roadsides and other waste places, chiefly in hot, dry and sandy localities (Bamber, 1916 ; Chopra *et al.*, 1958; Duthie, 1960; Kirtikar and Basu, 1933 ; Roberts, 1931 ; Sanyal and Ghose, 1934 and Watt, 1892).

It is known by different names in different parts of the country (Chopra *et al.*, 1958 ; Kirtikar and Basu, 1933 ; Roberts, 1931 and Sanyal and Ghose, 1934). Some of its common vernacular names are : *Chotagokhru*, *Gokhru*, *Gokshurah*, *Nerinnil*, *Nerunji* and *Siru Nerunji*.

The entire plant, specially the fruits and the roots are used in the Indian system of medicine (Chopra, *et al.*, 1958 ; Kirtikar and Basu, 1933; Nadkarni, 1954). According to *Bhava Prakasha* *T. terrestris* has cooling properties and gives strength, purifies bladder (diuretic action) and promotes digestive power. It is aphrodisiac, nutrient and is useful in renal calculi, urinary disorders, difficult breathing, cough and piles. According to *Saligram Nighantu*, it increases sexual power and is a tonic and overcomes excessive burning sensation, syncope, *tridosh*, skin diseases and colicky pain. In the Unani system of medicine the root is considered as a good stomachic and appetiser, emmenagogue, diuretic, carminative and cures lumbago. The fruits are regarded as cooling, diuretic, tonic and are used in painful micturition, urinary disorders and impotency. It is also used for cough and heart diseases, in the form of an infusion. The action of the drug on mucous membrane of the urinary tract resembles that of Buchu leaf and *Uvaursi* flowers. It is combined with Hyoscyamus and opium in inflammatory conditions of the urinary tract.

The drug has been the subject of some phytochemical (Bose *et al.*, 1963 ; Chopra *et al.*, 1958 ; Chopra and Ghosh, 1929 ; Ghatak, 1933 ; Henrici, 1938 ; Kachukhashvili, 1965) and pharmacological investigations (Chopra *et al*, 1958 ; Ghatak, 1933 ; Remington and Quin, 1933). In the pharmacognostical field very little work is on record (Aiyer *et al.*, 1953). The authors have given only a macroscopical description of the aerial parts of the drug.

*Research Officer, C. D. R. S. Pharmacognosy Unit.

**Head, Department of Pharmaceutics, B. H. U.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

In view of the importance of the drug in the indigenous system of medicine and inadequate information in the pharmacognostical field, it was deemed desirable to undertake a detailed investigation on this aspect. In the present investigation, detailed macro-and microscopical studies have been made on the root of *Tribulus terrestris* Linn. Recourse was also taken to investigate the fluorescence characteristics of the root powder to clearly elucidate the diagnostic characters.

Materials and Methods

Fresh specimens of the root of *Tribulus terrestris* Linn. growing in the campus of Banaras Hindu University, were collected at various stages of growth and development. Free hand and hand-microtome sections were taken, stained and mounted in the usual manner. Microchemical tests for cell contents and cell-wall structures were applied according to the procedures given by Johansen (1940) and Kay (1938). Fluorescence characteristics exhibited by the powder were noted according to the methods of Chase and Pratt (1949). For the study of the structure of isolated cells and tissues, small pieces of bark and wood region were separately macerated in Schultz's fluid, washed with water, teased and mounted in glycerine.

MACROSCOPICAL FEATURES

The plant has a tap root system, usually 7-18 cm long and 0.3-0.7 cm in diameter at its upper extremity. The roots are slender, cylindrical, fibrous, somewhat branched bearing a number of small rootlets. They are tough and woody, and externally light yellow to light brown in colour. The surface becomes rough due to the presence of small nodules. A transversely smoothened surface shows a thin bark and a broad zone of wood. The root breaks with fibrous fracture. Odour is aromatic and taste is sweetish and astringent.

MICROSCOPICAL CHARACTERS (PLATES I—III, FIG. 1—9).

Young root

The primary structure of the root (Figs. 1, 3) shows a layer of epidermis of small cubical cells. Some of the epidermal cells elongate to form root hairs. The epidermis is followed by 4-5 layers of thin-walled, isodiametric and circular parenchymatous cells of the cortex. The endodermis is distinct and the pericycle encloses a diarch stele (Fig. 3).

The secondary growth starts very early in the usual manner (Fig. 2, 4). The pericycle, opposite the protoxylem pole, divides first, followed by the phloem parenchyma cells, on the inner side. Thus a wavy cambium is formed which produces secondary phloem on the outer and the secondary xylem on the inner side. Soon a metaxylem central plate is formed. The pericycle also gives rise to phellogen which produces the cork on the outer and the phelloderm on the inner side. With further growth, the primary cortex and the epidermis rupture away. Opposite the two protoxylem poles, the medullary rays are first formed. Some of the phloem and the phelloderm cells soon become thick-walled and form fibres, in groups.

Mature root

In the mature root, the cork is represented by 4-6 layers of small, narrow, tangentially elongated to rectangular cells, arranged in regular radial rows (Fig. 6A). The phellogen is single layered. The phelloderm is a narrow zone of 6-14 layers of somewhat tangentially elongated and thin-walled parenchymatous cells, with varying number of fibres, distributed throughout this zone. Some of the parenchymatous cells of the phelloderm show secondary wall formation and reticulate thickening. The phelloderm fibres are found in groups

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

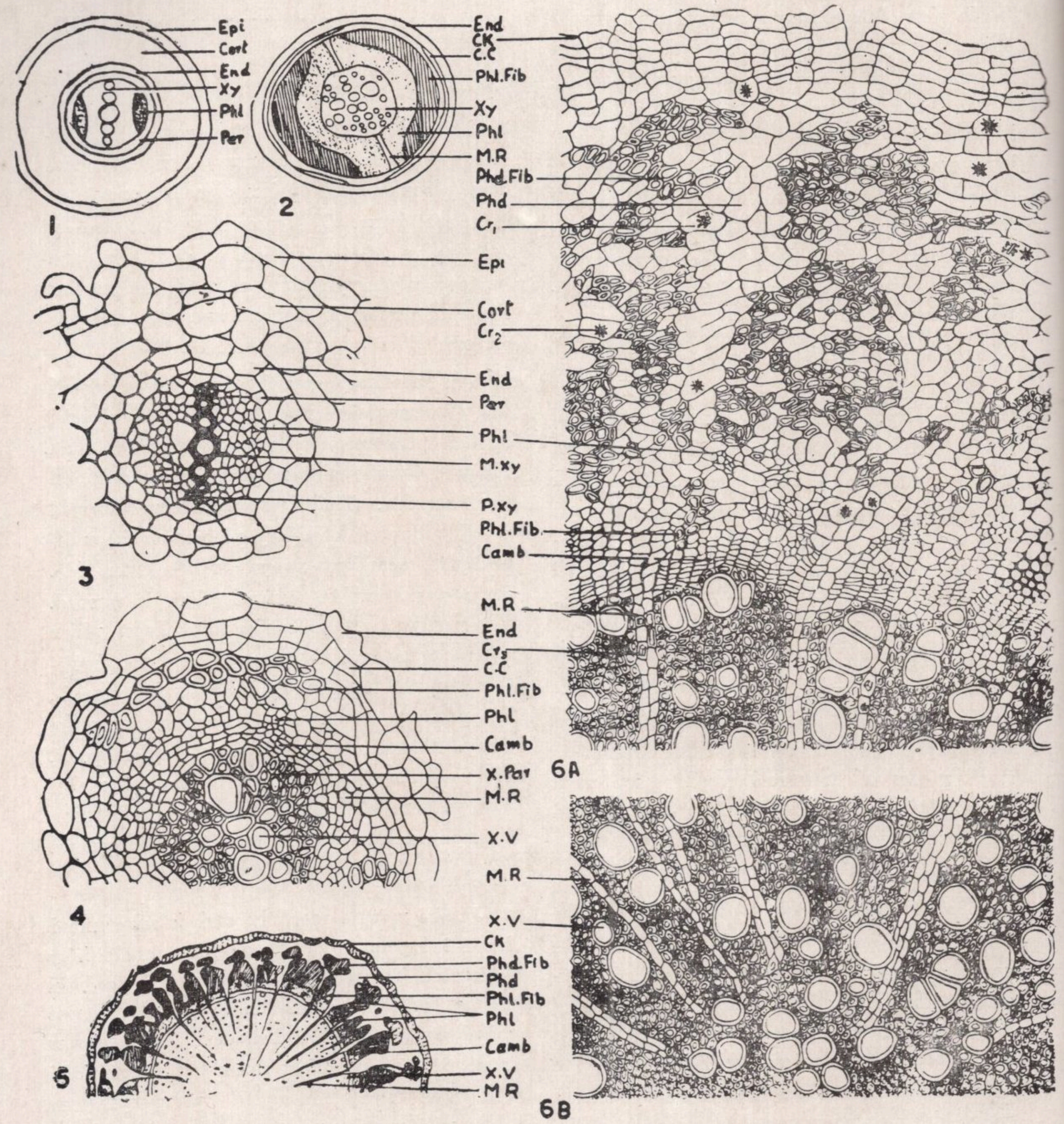
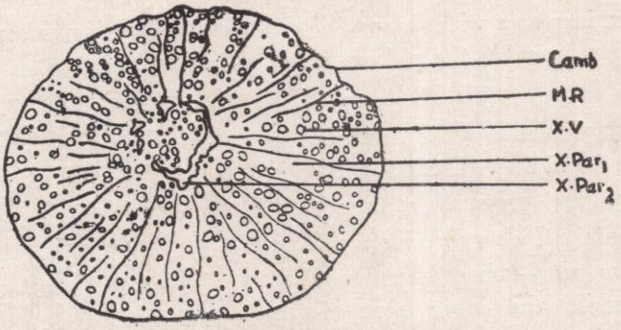


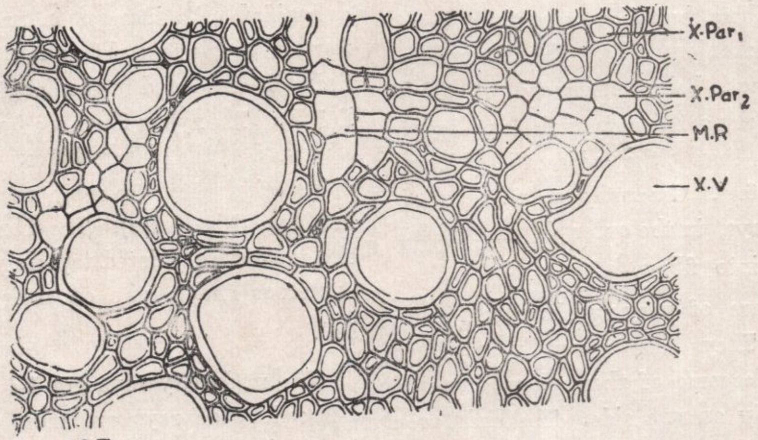
Fig. 1. Diagrammatic T. S. of young root showing diarch stele × 35.
Fig. 2. Diagrammatic T. S. of slightly mature root showing origin of cork cambium × 70.
Fig. 3. Details of T.S. of a portion of Fig. 1 × 130.
Fig. 4. Details of T.S. of a portion of Fig. 2 × 130.
Fig. 5. Diagrammatic T. S. of a portion of mature root × 65.
Fig. 6A. Details of T.S. of a portion of Fig. 5 showing bark and outer xylem region × 130.
Fig. 6B. Details of T.S. of a portion of Fig. 5 showing inner xlyem region × 130.

ABBREVIATION—Camb, cambium; C.C., cork cambium ; Cort, cortex ; Ck, cork; Cr_1. aggregates of prismatic crystal ; Cr_2, rosettes of calcium oxalate ; Cr_3, prismat-c crystals of calcium oxalate ; End, endodermis ; Epi, epidermis ; M.R., medullary ray ; M. Xy, meta xylem ; Per, pericycle ; Phd, phelloderm ; Phd, Fib, phellcderm fibre ; Phl, phloem ; Phl Fib, phloem fibre; P. Xy, protoxylem ; X. Par, xylem parenchyma ; X. V, xylem vessel ; Xy, xylem.

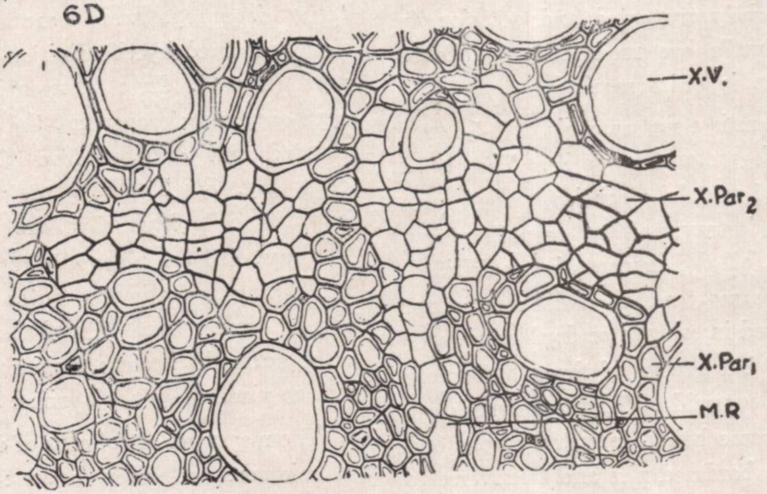
AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE



6C



6D



6E

Fig. 6C. Diagrammatic T. S. of wood of the root×65.

Fig. 6D. Details of T.S. of a portion of Fig. 6c showing outer region of wood×235.

F·g. 6E. Details of T.S. of a portion of Fig. 6c showing middle region of wood×235.

ABBREVIATION : Camb, cambium ; M. R, medullary ray ; X. Par_1, lignified xylem parenchyma ; X. Par_2, non-lignified xylem parenchyma ; X. V, xylem vessel.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

and their number increases with the age of the root. These fibres resemble the phloem fibres (*Vide infra*).

The secondary phloem may be divided into two zones (Figs. 5 and 6A). The outer zone is characterised by the presence of abundant strands of moderately thick-walled large phloem fibres with a few sieve-tubes in a somewhat crushed stage, while the inner zone of the secondary phloem is more or less parenchymatous and devoid of fibres, but shows plenty of sieve-tubes and companion cells. The medullary rays are distinct, being composed of thin-walled radially elongated cells which are larger in dimension than the adjacent phloem elements (Fig. 6A). Gradually a few cells of the medullary rays, in the outer phloem region, get converted into fibres.

The fibres are of varying shape and size (Fig. 8 *a-f*). They have generally peg-like outgrowth, while some of them show dentate outline, generally on one side. The ends are pointed or slightly truncated and occasionally forked. The walls are moderately thickened and the lumen is quite marked.

The cambium is a narrow strip of 3-5 layers of thin-walled rectangular cells. The wood is composed of vessels, tracheids, parenchyma and fibres and is traversed by medullary rays (Fig. 6A to E), all the elements being lignified. The vessels are scattered in a diffuse manner and are arranged in singles or doubles towards the inner-side, but groups of three to four are present on the outerside. They are cylindrical, drum-shaped, some being elongated at one end with numerous bordered pits and transverse to oblique articulation and well-marked perforation rims. In some cases these pores are found on one side of the lateral wall, particularly when the end is narrow and slightly tapering (Fig. 9*a-f*). The tracheids are long and narrow with tapering or sometimes forked ends. They have a number of simple pits on their walls (Fig. 9 *g-k*). The xylem parenchyma is rectangular or slightly elongated, occasionally showing reticulate type of thickening or simple pits (Fig. 9 *o-u*). In some fairly mature samples of the root, the xylem begins to show a tendency of delignification, particularly in the central region. In the beginning, a few xylem parenchyma get delignified but in later stages these delignified cells increase in number and thus form, near the central region, strands of delignified cells embedded in the lignified mass (Fig. 6 D & E). The xylem fibres are fewer in number as compared to the phloem fibres. In a macerated preparation they resemble the phloem fibres in shape (Fig. 9 *v-z*). The fibre tracheids are elongated with pointed tapering ends and have numerous simple pits on their walls (Fig. 9 *l-n*).

The medullary rays are 1-4 cells wide, but 1-2 cells wide rays are more common. The tetraseriate rays which are rarely seen are usually formed by the division of the triseriate rays (Fig. 7). In a tangential section, the rays appear heterogenous, the end cells being pointed and different from the rest of the cells (Fig. 7). The rays are 2-17 cells high, but 2-8 cells high rays are more common. The ray cells are oblong to radially elongated. Proceeding towards the outer side, the rays become wider and funnel-shaped. The ray cells gradually become somewhat thick-walled and at places they are lignified and pitted.

The measurement of cells of different tissues, in microns, are given below :—

Young root	
Epidermis	13-*19*-*30*-40 by 10-*16*-30
Cortex	20-*40*-*56*-66 (dia)
Mature root	
Cork	20-*32*-*44*-60 by 12-*18*-*22*-23

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

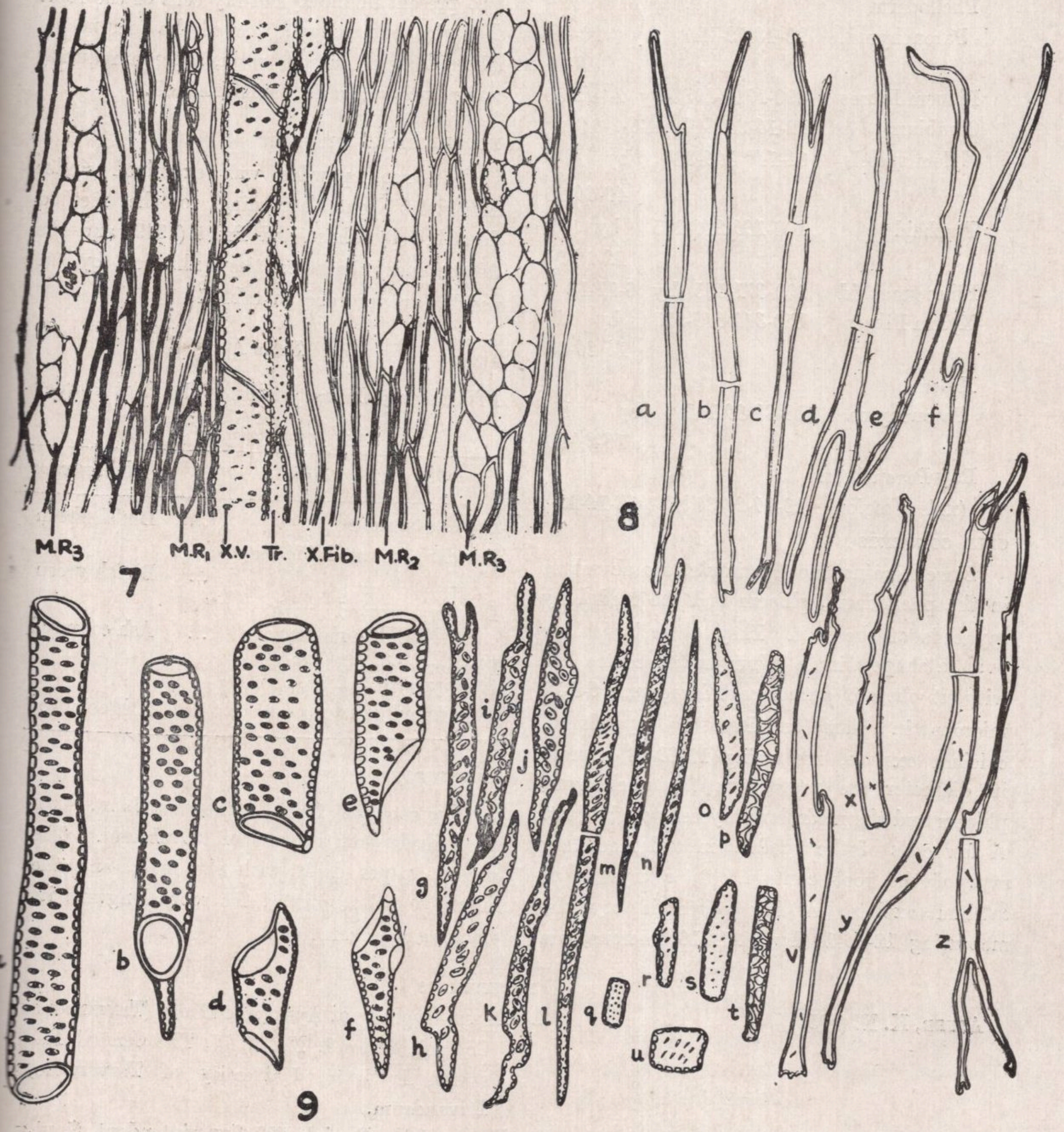


Fig. 7. Details of tangential section of root in the xylem reg on × 170.
Fig. 8a-f. Isolated elements of root bark (fibre) × 100.
Fig. 9. Isolated elements of xylem × 100.
a-f. Xylem vessels.
g-k. Tracheids.
l-n. Fibre tracheids.
o-u. Xylem parenchyama.
v-z. Xylem fibres.

ABBREVIATION : M. R_1, uniseriate medullary ray ; M. R_2, biseriate medullary ray ; M. R_3, triseriate medullary ray ; Tr, tracheid; X. Fib, xylem fibres ; X. V, xylem vessels

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Phelloderm Parenchyma	20-*48*-*72*-110 by 20-*32*-*48*-60
Phloem Fibres	890-*1760*-1982 by *14*-*42*-56
Cambium	12-*16*-*20*-24 by 4-*6*-*7*-8
Xylem vessels	64-*140*-*300*-384 by 20-*40*-*60*-80
Tracheids	100-*160*-*210*-285 by 6-*12*-*16*-24
Fibre tracheid	200-*371*-555 by 6-*11*-18
Xylem Fibres	150-*315*-*615*-975 by 7-*15*-*20*-36
Xylem Parenchyma	28-*68*-*80*-152 by 10-*16*-*24*-40
Ray Parenchyma (xylem region)	16-*20*-*26*-36 by 8-*12*-*14*-20

CELL CONTENTS

Starch grains, mostly simple, are abundant in the phelloderm, phloem and the medullary ray cells of the root. They are spherical or oval in shape with a hilum in the centre but without obvious striations and measure 6-*8*-12 microns in diameter. Rosette crystals of calcium oxalate, measuring 12-*20*-28 microns in diameter are present in the phelloderm, phloem and the medullary ray cells of the root. A few cells of the phelloderm and medullary rays of the root contain cluster crystals of calcium oxalate. A few prismatic crystals, measuring 12-*16*-20 by 12-*14*-16 microns, are also present in the xylem ray cells of the root. The alcoholic extracts showed the presence of alkaloid, sterol, tannin, resin, saponin, reducing sugar, polysaccharide and fixed oil.

FLUORESCENCE ANALYSIS

The root powder was examined under ultraviolet light, according to the method described by Chase and Pratt (1949) and the fluorescence characteristics exhibited by the powder are recorded in table 1.

Table 1

Fluorescence Characteristics of the Root Powder Under Ultraviolet Light.

Treatment	*Fluorescence*
Powder as sueh ...	Bluish green
Powder mounted in nitro-cellulose ...	Bluish green
Powder treated with 1N NaOH in methanol ...	Ash coloured
Powder treated with 1N NaOH in methanol and mounted in nitrocellulose ...	Ash coloured

Summary

The root of *Tribulus terrestris* Linn. is a prescribed constituent of *Dashmula*. The present paper deals with the macro-and the microscopical studies of the root alongwith its fluorescence characters.

REFERENCES

Aiyer, K. N. (1953) ... Pharmacognosy of Ayurvedic Drugs (Travancore-Cochin), Series 1, No. 2, 77, The Central Research Institute, University of Travancore, Trivandrum.

Bamber, C. J. (1916) ... Plants of the Punjab, 527, Superintendent, Govt. Press, Lahore.

Bose, B. C., Saifi, A. Q., Vijayavargiya, R. and Bhatnagar, J. N. (1963) ... Some aspects of chemical and Pharmacological studies of Tribulus terrestris, Ind. J. Med. Sci., 17(4), 291.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

CHASE, C. R. AND PRATT, R. (1949) ... Fluorescence of Powdered Vegetable Drugs with particular references to Development of a system of Identification, J. Amer. Pharm. Ass. (Sci. ed.), 38, 324.

CHOPRA, R. N., CHOPRA, I. C., HANDA, K. L. AND KAPOOR, L. D. (1958) ... Chopra's Indigenous Drugs of India, Sec. edn.' 430, U.N. Dhur and Sons Pvt. Ltd., Calcutta.

DUTHIE, J. F. (1960) ... Flora of the upper Gangetic Plain and of the Adjacent Siwalik and Sub Himalayan Tracts, Vol. I, 119, Botanical Survey of India, Calcutta.

GHATAK, N. (1933) ... Chemical examination of the fruits of Tribulus terrestris, Bull. Acad. Sci. United Provinces Agra and Oudh, 2, 163.

HENRICE, M. (1938) ... Some physiological aspects of the genus Tribulus J. Vet. Sci. Animal Ind., 10, 367, (cf. chem. Abs., Vol. 33, 42928, 1939).

HENRICE, M. (1947) ... *Tribulus terrestris*, content of assimilates, glucoside, and nitrates under different edaphic conditions, S. African J. Sci., *43*, 195. (cf. Chem. Abs. Vol. 42, 2325, 1948).

JOHANSEN, D. A. (1940) ... Plant Microtechnique, I. Ed., 182 McGraw-Hill Book Co. Inc., New York.

KACHUKHASHVILI, T. N. (1965) ... Diosgenin from *Tribulus terrestris* growing in Georgrin, S.S.R., Chem. Abstr., 63, 1654d.

KAY, L. A. (1938) ... The Microscopical Study of Drugs, 1 Ed., 18, Bailliere, Tindall and Cox, London.

KIRTIKAR, K. R. ANH BASU, B. D. (1933) ... Indian Medicinal Plants, Vol. II, 240, L.M. Basu, Allahabad.

NADKARNI, A. K. (1954) ... Dr. K. M. Nadkarni's Indian Materia Medica, 3rd. Ed. Vol. I., 1229, Popular Book Depot, Bombay.

REMINGTON, C. AND QUIN, J. I. (1933) ... Photosensitisation with special reference to the problem of jeeldikkop among small stock in S. Africa, S. African J. Sci., *30*, 461.

ROBERTS, E. (1931) ... Vegetable Materia Medica of India and Ceylon, 387, Plate Limited, Colombo.

SHARMA, P. V. (1956) ... Dravyagun Vigyan, Part II, III, 490, Chaukhamba Vidya Bhawan, Varanasi.

YADO SHARMA, T. (1950) ... Dravyagun Vigyan, Part 3, 122, Nirnaya Sagar Press, Bombay.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

हिन्दी सारांश

गोक्षुर मूल (ट्रिबुलस टिरेस्ट्रिस लिन) का औषधि प्रकृति विज्ञानीय अध्ययन

एम० एस० अन्सारी एवं एस० प्रसाद
(भेषज-विज्ञान विभाग, काशी हिन्दू विश्वविद्यालय, वाराणसी—५)

प्रस्तावना

गोक्षरु मूल आयुर्वेदीय दशमूल में वर्णित द्रव्यों में से एक है। यह पौधा वार्षिक तथा कभी-कभी बहुवर्षीय भी होता है। यह भूशायी पौधा है, इसकी शाखाएँ प्रतिशाखाएँ फैलती रहती है। यह सम्पूर्ण भारत में ११,००० फुट की ऊँचाई पर काश्मीर और पश्चिमी तिब्बत में तथा लंका जैसे उष्ण क्षेत्र में भी पाया जाता है। चरागाहों में, सड़कों के किनारे तथा अन्य अनुपजायी क्षेत्रों में होता है। गर्म, सूखे एवं बलुई भूमि में होता है (बम्बर, १९१६; चोपड़ा आदि, १९५८; दुथी, १९६०; कीर्तिकर और बसु, १९३३; राबर्ट्स, १९३१; सान्याल और घोष, १९३४; वार्ट, १८९२)। देश के विभिन्न क्षेत्रों में इसे छोटा गोखरु, गोखरु, नेरिन्निल, नेरुनजि, सिरुनिरुंजी आदि कहते हैं।

इस पौधे का सम्पूर्ण भाग विशेषकर फल तथा मूल का आयुर्वेदीय चिकित्सा पद्धति में बहुशः प्रयोग किया गया है (चोपड़ा आदि, १९५८; कीर्तिकर और बसु १९३३; नादकर्णी, १९५४)। भाव प्रकाश के आधार पर गोक्षुर में शीत गुणों का बाहुल्य है। इसे बल्य तथा मूत्रविरेचनीय एवं अग्निदीपक कहा गया है। इसके अतिरिक्त बाजीकर, बल्य, मूत्रकृच्छ नाशक, श्वासकास शामक, अर्श तथा बृक्कगत अश्मरी आदि रोगों में प्रयोग करने का शास्त्रीय उल्लेख है। शालिग्राम निवण्टु ने इसे मांसल, बल्य तथा जलन, मूर्छा, चर्मरोग, मरोड़ आदि के शमन में गुणकारी बताया है। यूनानी-चिकित्सा पद्धति में इसके मूल को दीपक, क्षुधाकारक, आर्तवोत्सारक, मूत्रल, वातसारी, कटिशूलनाशक कहा गया है। इसके फलों को शीतवीर्य, मूत्रल, वल्य तथा मूत्रकृच्छ, ध्वजभंग आदि रोगों में गुणकारी कहा गया है। इसके अतिरिक्त इसे कास और हृदय रोगों में देने का उल्लेख फण्ट के रुप में है।

मूत्रधराकला पर इसका प्रभाव वुकू पत्र तथा उवाउसी फल के सदृश है। इसका प्रयोग, मूत्रमार्ग गत शोथ में विजया तथा हायोसाइमस के साथ करने का निर्देश है। इस पादप पर रासायनिक अध्ययन बोस आदि (१९६३), चोपड़ा एवं घोष (१९२९), घटक (१९३३), हैनरीसी (१९३८), कछुखशवीली (१९६५) ने किया था। भेषजगुण विज्ञानीय अध्ययन चोपड़ा आदि (१९५८), घटक (११३३), रीमिंगटन एवं क्विन (१९३३) ने किया था। इस निबन्ध में किये गये औषधि प्रकृति विज्ञानीय अध्ययय का क्षेत्र अति सीमित है। ऐयर आदि (१९५३) अन्वेषकों ने अपने निबंध में इसके वायव्य भाग का स्थूल दर्शीय अध्ययन ही प्रस्तुत किया है। इस बात को ध्यान में रखकर इसका स्थूल दर्शीय तथा सूक्ष्मदर्शीय अध्ययन इस निबन्ध सें देने का प्रयास किया गया है। इसके मूल के चूर्ण का प्रतिदीप्त (फ्लोरेसेन्स) परीक्षण भी इसके विशेष गुणों के स्पष्टीकरण के लिए किया गया है।

सामग्री एवं विधि

गोक्षुर के मूल का संकलन पौधे के विकास की विभिन्न अवस्थाओं को ध्यान में रखते हुए काशी हिन्दू विश्वविद्यालय के क्षेत्र से किया गया। जानसन (१९४०), के (१९३८) की वर्णित विधि के आधार पर कोशाओं के आन्तरिक तत्वों तथा भित्तियों का सूक्ष्म रासायनिक परीक्षण सामान्यतया बनाये गये सेक्सन्स के आधार पर किया गया है। चेज एवं प्राट (१९४९) की विधि के आधार पर प्रतिदीप्त गुणों का विवेचन इसके चूर्ण में किया गया। इसके

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

पृथक्कृत छाल एवं काष्ठ की कोशाओं का रचनात्मक विवेचन शाल्ट्ज द्रव में मसल कर किया गया है।

विमर्श

स्थूलदर्शी अध्ययन के आधार पर गोक्षरु की जड़ें मूसला जड़ें कही जाती हैं। इनकी लम्बाई ७ से १८ सेन्टीमीटर तथा इनके अग्रिम भाग का व्यास ०·३ से ०·७ सेन्टीमीटर के बीच होता है। इसकी जड़ें सुकुमार, वृत्ताकार तन्तुवत होती हैं। इनकी शाखाएँ प्रतिशाखाएँ दिखाई पड़ती हैं। वे बड़ी कठोर तथा काष्ठ युक्त होती हैं। इनका रंग हल्के पीले से लेकर हल्के भूरे रंग का होता है। इसको वाह्यभित्ति पर्विका (नोड्यूल) की उपस्थिति से खुरदरी होती है। यदि इसका सेक्शन तिर्यक (ट्रान्सवर्स) ढंग से काटा जाय तो वाहरी छाल पतली और बीच का भाग काष्ठ युक्त होता है और आसानी से तोड़ा जा सकता है तथा सुगन्धित होता है। इसका स्वाद मीठा तथा कदाचित् कषाय युक्त होता है।

कागत्वचा, अन्तस्त्वकः

नयी एवं पूरानी जड़ों की वाह्यभिति, वाह्यक, अन्तर्वल्कल, मृदूतक दारूवाहिनिकी, वल्कल, रेशे की परत, रसवाहिनी आदि का सूक्ष्मदर्शी अध्ययन का विवरण सविस्तार प्रस्तुत किया गया है। कोशाओं से प्राप्त श्वेतसार, कैल्शियम आक्सलेट आदि के रवों का वर्णन किया है। गोक्षुर के अल्कोहलीय सार में सक्रिय तत्व स्टेराल, टैनिन, राल, सैपोनिन, शर्करा, पालीसैकेराइड तथा स्थिर तैल आदि पाये गये। साथ ही विशेष विवरण के लिये प्रदीप्त परीक्षण से प्राप्त विवरणिका भी अन्त में निबद्ध है।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4, 2, 1970.

PHARMACOGNOSTIC STUDY OF LEAVES OF PLUCHEA LANCEOLATA C. B. CLARKE & OLIVE (RASNA)

S. PRASAD*, C. S. SHAH**, N. S. SHAH***, M. S. ANSARI**** AND
MISS. R. MITRA*****

(*Department of Pharmaceutics, B.H.U. Varanasi and Department of Pharmacognosy, L.M. College of Pharmacy, Ahmedabad-9*)

[Received for Publication on April 28, 1969]

Introduction

Pluchea lanceolata (Fam. Compositae) is distributed in upper Bengal, Gangetic Plain, Punjab, Sindh and also in Afghanistan, Baluchistan and N. Africa (Chopra, *et al.*, 1956; Duthie, 1960; Kirtikar and Basu, 1933; Misra, 1954 and Singh 1955).

The plant is commonly known as *Rasna* in Sanskrit, Hindi and Marathi. Especially in Uttar Pradesh it is considered by many as real *Rasna* of the Ayurveda (Singh, 1955). The plant is used for the same medicinal purposes as *Vanda roxburghii* (Family-Orchidaceae), which is also considered as *Rasna* in Bihar and Bengal. The leaves of *P. lanceolata* are known to be aperient and used as substitute for senna (Chopra *et al.*, 1958; Chopra, *et al.*, 1956; Joachinowitz, 1923; Kirtikar and Basu, 1933).

Das Gupta (1967) reported compounds A, B, C from petroleum ether extract. Compound B being probably Taraxasterol and compound C probably the γ-sitosterol. Alcoholic extract of the defatted drug contained considerable amounts of water soluble quarternary bases like pluchine, and very little tertiary bases. Prasad *et al* (1965, 1966) showed that pluchine had anti-inflammatory action.

As no pharmacognostical work is reported uptill now, the present investigations were carried out.

Materials and Methods

The leaves of *P. lanceolata* were collected from Banaras Hindu University campus and also from Meerut (U.P.) supplied by Shri A. C. Dey, Survey Officer of I.C.M.R. The general characters of both the leaves are the same except where specified below. The methods followed were the usual ones.

EXPERIMENTAL AND RESULTS

Macroscopy

The leaves (Fig. 1, 1A) are simple, alternate sessile, green 1.5-3-4-6.5 cm in length and 0.4-0.8-1.0-1.5 cm in breadth. They are coriaceous, oblong, lanceolate or oblanceolate, narrow at the base with margin entire or toothed round the apex. Apex is acute or apiculate. Main veins are prominent on both sides and lateral veins leave the mid-rib at an acute angle. Both the surfaces are pubescent and the trichomes are closely appressed to the surface. Texture is thin and brittle. Odour is characteristic and taste is astringent and slightly bitter.

* Head of the Department of Pharmaceutics, B. H. U., Varanasi.
** Principal L. M. College of Pharmacy, Ahmedabad-9. (Gujart State)
*** Research Officer, Pharmacognosy Unit (Ahmedabad Unit), Circuit 3, I.C.M.R.
**** Research Officer, Pharmacognosy Unit (Banaras Unit), Circuit-6, I,C,M,R.
***** Assistant Research Officer Circuit 6. I.C. M. R. Work carried out under I. C, M. R. Scheme.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

The leaves obtained from Meerut (Fig. 1) are yellowish green oblong or oblanceolate, narrow at the base and having entire margin. They are less pubescent and in texture thicker, tough and flexible compared to Banaras sample.

Microscopy

The lamina (Fig. 4) is isobilateral consisting of 2 to 4 rows of palisade cells on both the sides below the epidermises. In transverse section the epidermis consists of mostly tangentially elongated cells covered on the outside with thick cuticle which is usually striated. The stomata (Fig. 5) are of cruciferous or ranunculaceous type. Numerous covering trichomes (Fig. 6.) present on both surfaces are uniseriate, multicellular having 2 to 5 cells with an oval base. Sometimes, upper one or two cells of the trichomes are collapsed. In many trichomes the uppermost cell is very long. The spongy tissue of mesophyll consists of loosely arranged 3-5 rows of parenchyma which is traversed by lateral veins. Usually small crystals of calcium oxalate either cluster or aggregate of prisms are found. Very small oil globules are also distributed throughout. The transverse section through the mid-rib (Fig. 2-3) shows below the epidermises 4 to 6 layers of collenchyma. At the upper part of the leaf, in the mid-rib, there is one vascular bundle, while at the base there are 3-5 vascular bundles. Vascular bundles are accompanied by thick walled lignified fibres.

The quantitative microscopic constants are :

Vein—islet number—13-29

Stomatal Index—Upper surface 14-20-24

,, ,, —Lower ,, 20-22-24

Palisade ratio—2—3.4—5

Ash and extractive values are obtained according to I.P. 1966.

	The Values obtained from Banaras Sample found by Banaras Unit	The values obtained from Meerut Sample found by Ahmedabad Unit
Ash Values	18.2%	14.00%
Acid insol. Ash	5.2%	0.7%
Water Sol. Extractive	19.57%	35.60%
Alcohol Sol. Extractive	9.75%	32.40%
Crude Fibre	6.45%	6.77%
	(Banaras Sample)	(Meerut Sample)
Length of Trichomes		
Upper Surface :	152-760-1064-1672 μ	123-243-371 μ
Lower Surface :	144-680-1344-1760 μ	120-292-446 μ

Methanolic extract of the leaves shows the presence of flavones according to Luckner (1966).

Fluorescence analysis under U.V. Light according to Chase and Pratt (1949), carried out by Banaras Unit (Circuit-6) of Banaras Sample.

Treatment	*Fluorescence*
1. Powder as such	Yellowish green.
2. Powder mounted in nitrocellulose	Dirty green.
3. Powder treated with NaOH in methanol	Deep yellowish green.
4. Powder treated with NaOH and mounted in nitrocellulose	Deep yellowish green.

Fluorescence analysis under U.V. light carried out by Ahmedabad Unit. (Circuit-3)—10% of the filtered extract after macerating the drug for 24 hours is used.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Sr. No.	Solvent	Meerut sample	Banaras sample
1.	Acetone	Dark red	Bright scarlet red
2.	Benzene	Pale scarlet red	Scarlet red
3.	Carbon tetra chloride	Pale scarlet red	Scarlet red
4.	Chloroform	Pale scarlet red	Scarlet red
5.	Ethanol	Dirty violet	Bright scarlet red
6.	Ether	Scarlet red	Bright scarlet red
7.	Ethyl acelate	,, ,,	,, ,, ,,
8.	Light petroleum	Pale scarlet red	Pale scarlet red
9.	Methanol	Dirty violet	Dark scarlet red
10.	Water	Dark brown	Dirty brown

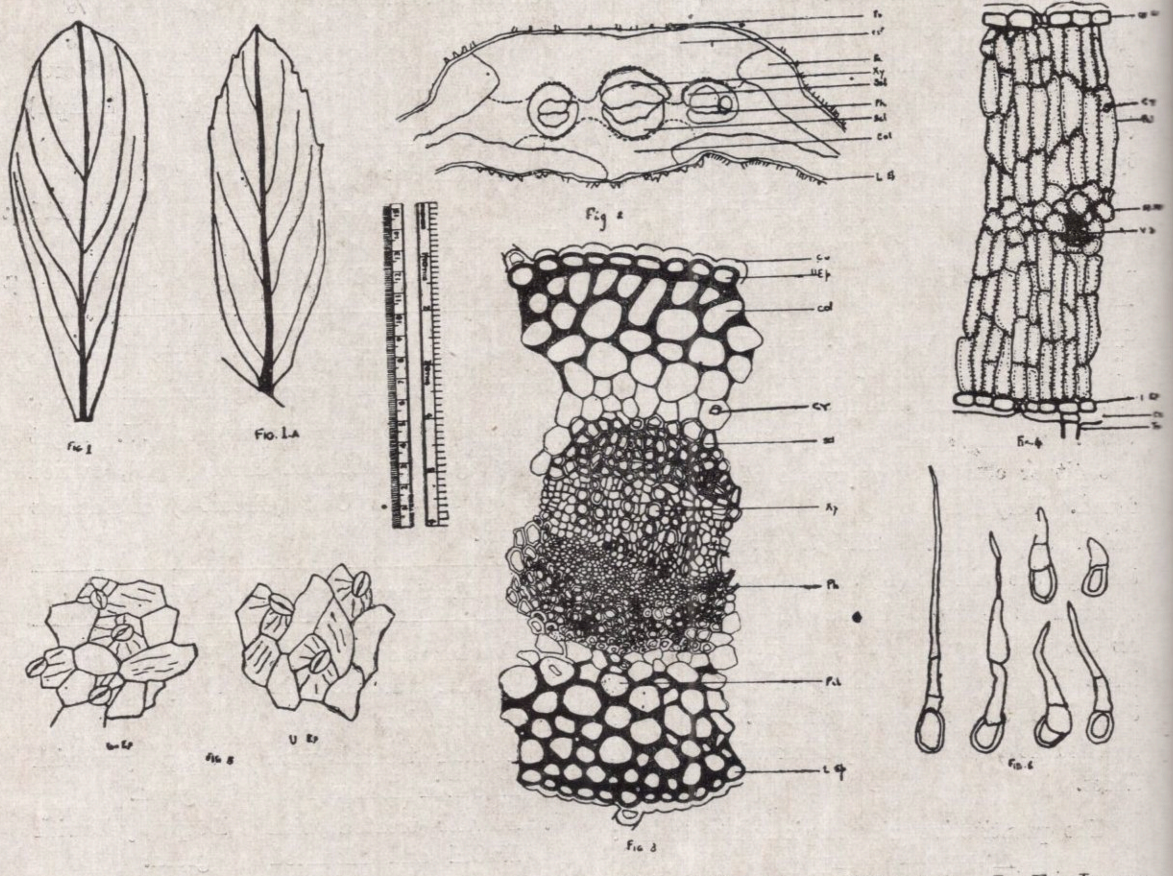


Fig. 1. Pluchea lanceolata leaf × 7.
Fig. 2. Diagrammatic transverse section of leaf through mid-rib near base × 72.
Fig. 3. T.S. of leaf through mid-rib × 320.
Fig. 4. T.S. of leaf through lamina × 320.
Fig. 5. Epidermis, Upper and lower × 320.
Fig. 6. Trichomes of leaf × 320.

Col.—Collenchyma ; CU-cuticle ; L. Ep.-Lower epidermis ;
Pal.—Palisade ; Ph-Phloem Pit-Pits ; Scl-Sclerenchma ;
Sp. Mes.—Spongy mesophyll ; Tr-Trichome ; Tr. B.—Trichome base ;
U. Ep.—Upper epidermis ; V.B.-Vascular bundle ; Xy-xylem.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Discussion

In view of the differences it would be interesting to make a comparative phytochemical and pharmacological study.

Summary

Pharmacognostic study including ash values, extractive constants, fluorescence analysis *etc.* of *Pluchea lanceolata* leaves from Banaras and Meerut have been studied and distinguishing features of the two have been mentioned.

REFERENCES

1. Chase C. R. & Pratt. R. (1949) ... J. Amer. Pharm. Assoc. Sci., edi. 38 : 324.
2. Chopra R. N., Chopra I. C., Handa K. L. & Kapur L. D. (1958) ... Chopra's Indigenous Drugs of India (2nd. Edition) P—433, 520, U.N. Shur & Sons Limited, Calcutta.
3. Chopra R. N., Nayar S. L. and Chopra I. C. (1956) ... Glossary of Indian Medicinal Plants P. 197, P. 252. C.S.I.R. New Delhi.
4. Das Gupta B. (1967) ... Experientia 23, 989, Brikhauser, Verlag, Basel (Schwiez).
5. Duthie J. F. (Revised Edn. 1960) ... Flora of Upper Gangetic Plain and of adjacent. Siwalik and Sub-Himalayan Tracts. Vol. I, P. 290, Botanical. Survey of India, Calcutta.

हिन्दी सारांश

रास्ना (प्लूचिया लैन्सियोलाटा सी बी क्लार्क एवं ओलिव) पत्र का औषधि प्रकृति विज्ञानीय अध्ययन

एस० प्रसाद, सी० एस० शाह, एन० एस० शाह, एम० एस० अन्सारी एवं कुमारी रोमा मित्रा
(भेषज विज्ञान विभाग, का० हि० वि० वि० वाराणसी एवं एल० एम० औषधि निर्माण महाविद्यालय, अहमदाबाद)

प्रस्तावना

रास्ना उत्तरी बंगाल, गंगा के तटवर्ती क्षेत्र, पंजाब, सिन्ध, अफगानिस्तान, बलूचिस्तान तथा उत्तरी अफ्रीका में पायी जाती है। (चोपड़ा १९५६, डथी १९६०, कीर्तिकर एवं बसु १९३३, मिश्र १९५४ एवं सिंह १९५५)। संस्कृत, हिन्दी और मराठी में इसे रास्ना ही कहते हैं। आयुर्वेदज्ञ उपर्युक्त रास्ना को ही रास्ना मानते हैं। परन्तु, बिहार और बंगाल में बाण्डा राक्सबर्गीयाई को भी रास्ना मानते हैं। पी० लैन्सीयोलेटा को सनाय के अभाव में मृदु विवेचक के रूप में देने का उल्लेख चोपड़ा आदि (१९५८), चोपड़ा नायर आदि (१९५६), जोयाचिनोविट्स (१९२३), कीर्तिकर एवं बसु (१९३३) ने किया है। दासगुप्त (१९६७) ने इसके पेट्रोलियम ईथर से प्राप्त घनसत्व में ए०, बी०, सी० नामके यौगिकों के होने का उल्लेख किया है, इसमें यौगिक 'बी' को सम्भवतः टेराक्सास्टेराल तथा 'सी' को गामा-सीटास्टेराल माना है। इस औषधि के वसा रहित अल्कोहलीय सारतत्व में जल से घुलनशील प्लूचीन नामक क्वार्टरनरी बेस तथा थोड़ी मात्रा में टर्सीयरी बेस प्राप्त हुए हैं। प्रसाद आदि ने (१९६५, १९६०) प्लूचीन में शोथहर गुणों का उल्लेख किया है।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

सामग्री एवं विधि

पी० लैंसीयोलेटा की पत्तियां काशी हिन्दू विश्वविद्यालय के क्षेत्र से तथा श्री ए० सी० दे, सर्वेक्षण अधिकारी आई० सी० एम० आर०, मेरठ (उत्तर प्रदेश) से प्राप्त की गयी। दोनों तरह से प्राप्त पत्रों में सामान्यतया कुछ स्थलों को छोड़कर एक रूपता थी तथा उनका सूक्ष्यदर्शी अध्ययन बहुप्रचलित सामान्य विधियों पर ही किया गया।

विमर्श

स्थूलदर्शी अध्ययन के आधार पर इसकी पत्तियां साधारण एकान्तर क्रम से, पर्णवृन्त रहित, हरी, १.५ से ३-४, ६.५ सेन्टीमीटर लम्बाई, में तथा ०.४-०.८-१.०-१.५ सेन्टीमीटर चौड़ाई में रही। इनका स्वरूप चर्मसदृश, गोलाकार, नुकीली, तथा मूल में पतली तथा किनारे दाँतेदार होते हैं। इसके एपेक्स कोणात्मक होते हैं। मुख्य शिराएं दोनों तरफ होती हैं तथा वाममार्गी शिराएं मध्यशिरा से न्यूनकोण पर निकलती हैं। पत्र के दोनों सतह रोम युक्त होते है। ये रोम सतह से सटे रहते हैं तथा पतले एवं भुरण शील होते हैं। गन्ध विचित्र ढ़ंग की तथा स्वाद कषला तथा थोड़ा तिक्त होता है। मेरठ से प्राप्त पत्र काशी हिन्दू विश्वविद्यालय से प्राप्त पत्रकी अपेक्षा पीले एवं हरे होते हैं। ये पत्र गोले तथा नुकीले होते हैं, रोएं थोड़े मोटे, कड़े तथा लचीले होते है।

मेरठ एवं वाराणसी से प्राप्त रास्ना पत्रों का सूक्ष्मदर्शी अध्ययन से केशिकाओं, रन्ध्र संकेत एवं पेलीसेड अनुपात में काफो अन्तर रहा। इन्डियन फर्माकोपिया (१९६६) के आधार पर प्राप्त राख एवं सारतत्वों की मात्रा में स्पष्ट अन्तर देखा गया। यही अन्तर प्रदीप्ति परीक्षण एवं अन्यान्य रासायनिक घोलकों के द्वारा भी पुष्ट हुआ।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4, 2, 1970.

PHARMACOGNOSTICAL STUDY OF LEAF OF VITEX NEGUNDO LINN. (NIRGUNDI)

S. PRASAD* AND A. K. WAHI**

(*Department of Pharmaceutics, Banaras Hindu University, Varanasi-5*)

[Received for publication on February 22, 1969]

Introduction

Vitex negundo Linn. (family-Verbenaceae) is a large shrub or small slender tree. It is distributed throughout India and also grows in Ceylone, Afghanistan, tropical Africa, Madagascar, China and Phillippines. It is commonly known as *Mewari, Nirgundi, Shiwali* and *Shiwari* in Hindi and *Indrani, Shephali, Surasa* in Sanskrit. The leaf of the plant is used as astringent, tonic, vermifuge, carminative, stomachic, anthelmintic and expectorant. It is also useful in diseases of the eye, consumption, inflammations, leucoderma, enlargement of the spleen, bronchitis, asthma, painful teething of children, biliousness, swelling of joints and dullness of hearing (Kirtikar and Basu, 1933; Sharma, 1956).

The drug was subjected to pharmacognostical study earlier by Madan and Nayar (1959) but their findings are meagre and inadequate (*vide* discussion) and hence a thorough and detailed study has been undertaken.

Material and Methods

The leaves of *Vitex negundo* were collected from the garden of Department of Pharmaceutics and Ayurvedic Garden of Banaras Hindu University. Hand and microtome sections were taken, stained and mounted in usual manner. Cell content and cell wall structure studied according to the procedure described by Kay (1938) and Johansen, (1940). Methods for determining the quantitative values were same as described by Wallis (1933).

MACROSCOPICAL CHARACTERS

The leaf is palmately compound and is mostly trifoliate and occasionally digitate (five foliate). In the trifoliate leaf, middle leaflet has a petiolule 10-25 mm long and the remaining two are subsessile. In the digitate leaf, inner three leaflets have petiolule and the remaining two are subsessile. The petiole is 25-40 mm long. The leaflets are lanceolate, acute, entire or rarely crenate, subglabrous on ventral and tomentose on dorsal side. The leaflets show unicostate reticulate venation and leathery texture.

MICROSCOPICAL CHARACTERS

Petiole

The petiole (Plate I, Fig. 1-3) shows single layered epidermis composed of thinwalled cubical to oval cells. Most of the epidermal cells elongate to form unicellular and uniseriate, multicellular hairs. The bicellular hairs are by far the largest in number. The glandular hairs are also present and consist of uni—to tricellular stalk and uni—to bicellular head. The epidermis is followed by a wide zone of collenchyma which is well developed in the basal region and gradually becomes less in the middle and apical regions. The collenchymatous cells show well developed angular thickening. Below the

* Prof. and Head of the Department.

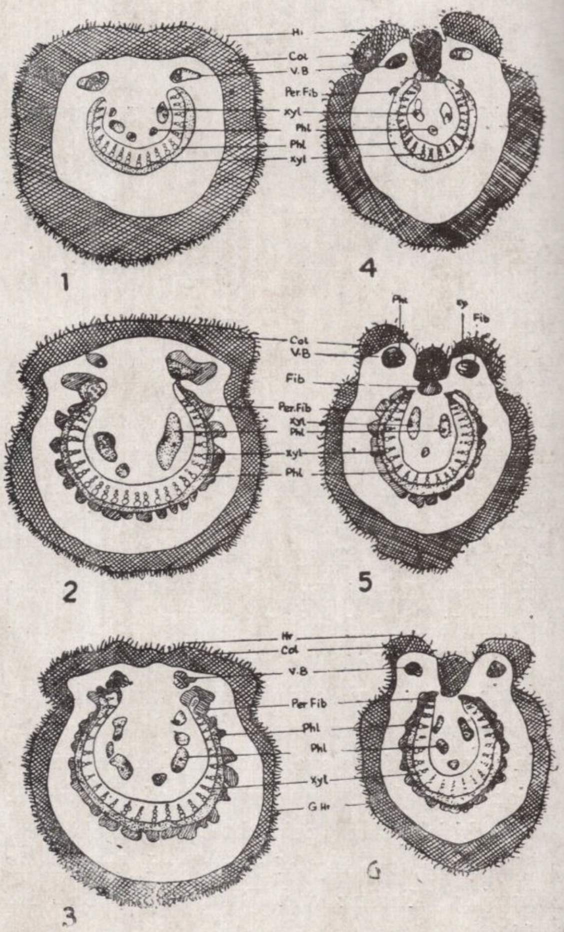
** Lecturer.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

collenchyma is parenchyma 6-8 layers thick. The basal region of the petiole shows the absence of pericyclic fibres which start developing towards the apical region and form discontinuous ring surrounding the central horse-shoe shaped vascular bundle. A few vascular bundles are present ventrally between the arms of the central horse-shoe shaped vascular bundle and two or rarely three vascular bundles are situated opposite to the arms. The large central vascular bundle has a continuous phloem and radial rows of xylem seperated by medullary rays. The phloem consists of sieve tubes, companion cells and phloem parenchyma, while xylem consists of vessels, tracheids and xylem parenchyma. The vascular bundles situated ventrally are smaller and mostly represented by phloem elements and in some cases are associated with a few xylem elements and phloem fibres. However, the two bundles lying opposite to the arms of the central vascular bundle show similar arrangement of xylem and phloem as the large central bundle.

Petiolule

The petiolule (Plate I, Fig. 4-6) has a single layer of epidermis and is covered externally with lesser number of hairs as compared to petiole but their description and size follow the same pattern as in the case of petiole. The epidermis is followed by a wide zone of collenchyma with prominent angular thickenings. The basal and middle regions show absence of collenchyma near the ventral groove. Below the collenchyma is 6-8 cells wide parenchyma. At different regions from base to apex, the development of pericyclic fibres and vascular bundles follow more or less the same pattern as in the petiole. However, the petiolule shows a group of fibres between the arms of the central vascular bundle, just below the collenchyma on the ventral side.



Microscopical characters of petiole and petiolule of *Vitex negundo*

Fig. 1. T.S. of petiole of basal region (diagrammatic) $\times 26$

Fig. 2. T.S. of petiole of middle region (diagrammatic) $\times 35$

Fig. 3. T.S. of petiole of apical region (diagrammatic) $\times 35$

Fig. 4. T.S. of petiolule of basal region (diagrammatic) $\times 35$

Fig. 5. T.S. of petiolule of middle region (diagrammatic) $\times 45$

Fig. 6. T.S. of petiolule of apical region (diagrammatic) $\times 45$

Col, Collenchyma ; Fib, Fibre ; G. Hr, Glandular hair ; Hr, Hair ; Per. fib, Pericyclic fibre ; Phl, Phloem ; V.B, Vascular bundle ; Xyl, Xylem.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Midrib

The midrib (Plate II, Fig. 7-9, 16) shows a single layered epidermis composed of thick-walled cubical cells. The lower epidermis bears larger number of hairs than the upper epidermis. The distribution, shape and size of the hairs are the same as seen in the petiole. The epidermis is followed by 6-10 layers of collenchymatous cells on the ventral and 3-6 layers on the dorsal side. Below the collenchyma is parenchyma, 6-8 cells wide on the dorsal side. Unlike petiole and petiolule, the basal region of midrib shows a discontinuous ring of fibres, capping phloem on the dorsal side. These fibres gradually diminish towards the apical region. The vascular bundles of the midrib have more or less similar structure and distribution as in the petiole and the petiolule except that the two vascular bundles lying opposite to the arms of the central vascular bundle are absent. However, like petiolule, a group of fibres is present below the collenchyma of the ventral side.

Lamina

The lamina (Plate II, Fig. 11-14) shows a single layered epidermis on the upper side composed of cubical cells. The upper epidermis shows mostly unicellular hairs; bi- and multicellular hairs and glandular hairs are rare. Following the epidermis is a layer of hypodermis which is usually 1-2 layers of cells thick and is interrupted at places by the palisade layer, which is 4-7 cells deep, occupies the whole of the mesophyll excepting the parenchyma of the transcurrent veins. The cells of the lower epidermis are cubical in shape and mostly form uni- tricellular trichomes and a few glandular hairs. The shape and size of these hairs are similar as seen in the petiole. Stomata are present on the lower surface of leaf only and are densly covered with trichomes. A large number of veins traverse the mesophyll. They are transcurrent. Each small vein is represented by three to five xylem elements and 4-6 phloem elements surrounded by four to six cells of the bundle sheath. In the case of slightly bigger veins the bundle sheath is composed of more cells with larger number of transcurrent parenchyma. At the tip of the margin of the leaf, the palisade cells are replaced by isodiametric type of cells which become slightly thickwalled. The average vein-islet and vein termination number of the leaf are 23.99 and 6.26 respectively.

Measurements of different cells of leaf of *Vitex negundo*

Petiole

Epidermal cells—6-*12*-20μ by 8-*14*-18μ

Unicellular hairs—6-*14*-20μ by 4-6-10μ

Bicellular hairs—30-*115*-200μ by 4-*8*-12μ

Glandular hairs—length, 15-*28*-58μ; head, 12-*18*-24μ; basal cell, 4-*8*-12μ.

Parenchymatous cells—18-*30*-50μ by 10-10-*28*-44μ

Midrib

Epidermal cells—8-*16*-24μ by 8-*14*-18μ

Parenchymatous cells—20-*36*-56μ by 12-*28*-44μ

Lamina

Lower epidermal cells—10-*18*-30μ by 8-*14*-22μ

Upper epidermal cells—8-*16*-28μ by 7-*12*-18μ

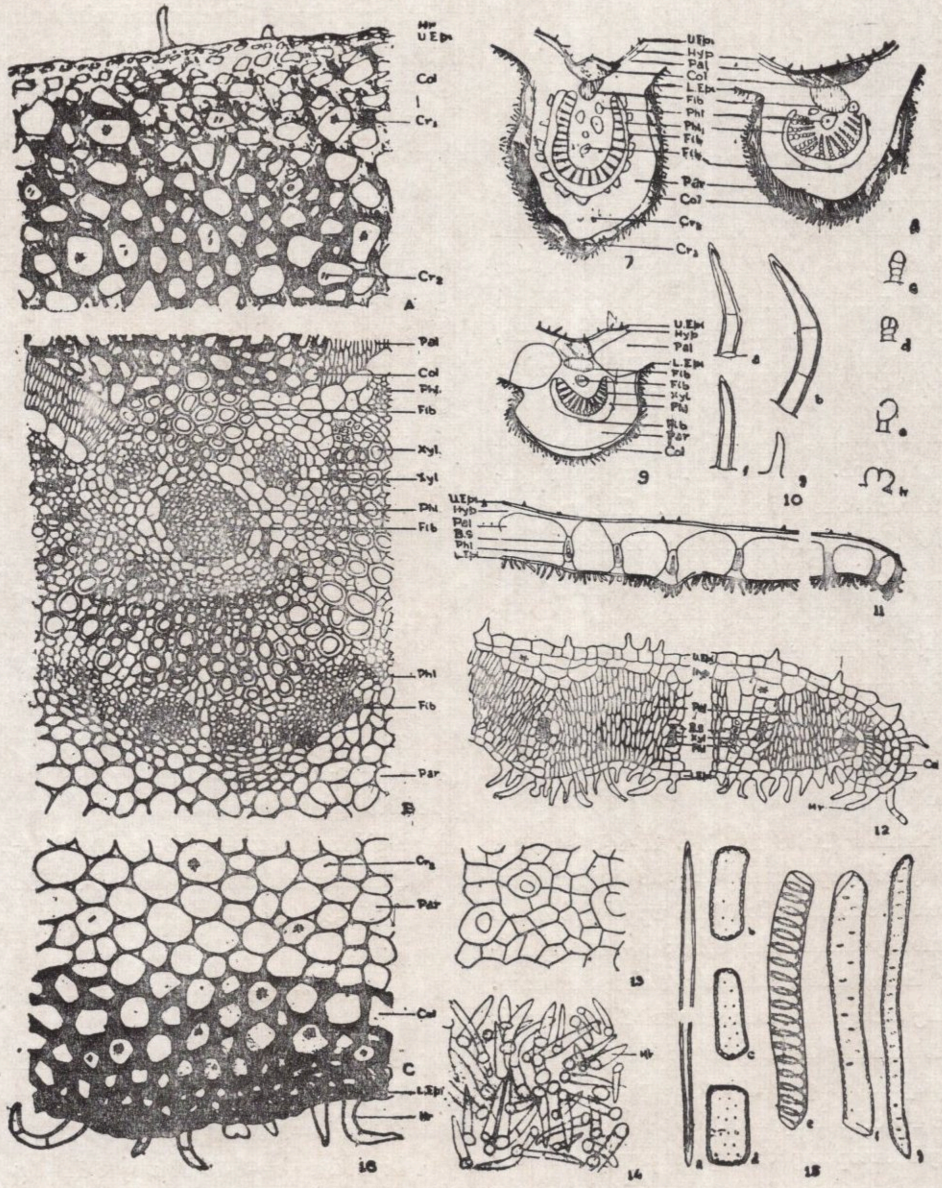
Palisade—9-*12*-*18*-28μ by 4-7-12μ

Hypodermis—8-*10*-32μ by 6-*14*-20μ

CELL CONTENTS

Rosette crystals of calcium oxalate are present in collenchymatous and parenchymatous cells of the midrib and hypodermis of the lamina. Prismatic crystals of calcium oxalate are present in parenchymatous cells of the midrib. The palisade cells of lamina and cortical cells

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE



Microscopical characters of midrib and lamina of *Vitex negundo* leaf

Fig. 7. T.S. of midrib of basal region diagrammatic × 27
Fig. 8. T.S. of midrib of middle region diagrammatic × 27
Fig. 9. T.S. of midrib of apical region diagrammatic × 27
Fig. 10. Different types of hairs × 150
Fig. 11. Part of T.S. of lamina diagrammatic × 53
Fig. 12. Part of T.S. of Fig. 11 showing cellular details × 150
Fig. 13. Surface view of the leaf showing hair markings × 150
Fig. 14. Surface view of the leaf showing hairs × 150
Fig. 15. Isolated elements of the leaf × 223 a : Fibre
b-d : Xylem parenchyma e-f : Vessels g : Tracheid
Fig. 16. Part of T. S. of Fig. 8 showing cellular details × 150
A : Upper epidermis and collenchyma
B : Middle region of midrib
C : Cortex and lower epidermis

B.S, Bundle sheath ; Col, Collecnchyma ; Cort, Cortex ; Cr1, Rosette cyrstals of calcium oxalate ; Cr2, Prismatic crystals of calcium oxalate ; Fib, Fibre ; G. Hr, Glandular hair ; Hr, Hair ; Hyp, Hypodermis, L. Epi, Lower epidermis ; Pal, Palisade ; Phl, Phloem ; Par, Parenchyma ; U. Epi, Upper epidermis ; Xyl, Xylem ; Xyl. par, Xylem parenchyma.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

of midrib show presence of volatile oil and tannin. The alcoholic extract of the leaf revealed the presence of alkaloid and glycoside.

Discussion

From the foregoing description it will be seen that the petiole and the midrib show a great deal of structural variations at different regions *viz.*, basal, middle and apical. On this point, findings of Madan and Nayar (1959) are inadequate and are not in agreement with the observations recorded herein. They have mentioned that the vascular arc is surrounded by a sclerenchymatous band in the midrib and the petiole, whereas we find that there is no sclerenchymatous band surrounding the vascular arc in the basal region of petiole but gradually develops towards the apical region. Likewise in the case of midrib, sclerenchymatous band is present only in the basal region and diminishes in the middle and apical regions and is represented by 1-2 patches of 2-3 fibres. They have also not reported the presence of group of fibres lying below the collenchyma on the ventral side in the midrib. Further, they have not undertaken the study of petiolule and also not given any account of the hypodermis below the upper epidermis in the lamina.

REFERENCES

1. Johansen, S. A. (1940) ... Plant Microtechnique, 1st Edn., 182, Mc. Graw Hill Book Co. Inc., New York and London.
2. Kay, L. A. (1938) ... Microscopical Studies of Drugs, 1st Edn., 18, Bailliere, Tindall and Cox., London.
3. Kirtikar, K. R. and Basu, B. D. (1933) ... Indian Medicinal Plants, *III*, 1938, L. M. Basu, Allahabad.
4. Madan, C. L. and Nayar, S. L. (1959) ... Pharmacognostic study of leaf and root of *Vitex negundo* Linn., *J. Sci. Ind. Res.*, *18C*, 10.
5. Sharma, P. V. (1956) ... Dravya Gun Vigyan, 1st Edn., *II*, 60, Choukhamba Vidya Bhawan, Varanasi.
6. Wallis, T. E. (1953) ... Practical Pharmacognosy, J. & A. Churchill., London.

हिन्दी सारांश

निर्गुण्डी पत्र का औषध प्रकृति विज्ञानीय अध्ययन

एस० प्रसाद एवं ए० के० वाही

(भेषज विज्ञान विभाग, काशी हिन्दू विश्वविद्यालय, वाराणसी)

प्रस्तावना

निर्गुण्डी क्षुप लंका, अफगानिस्तान, भूमध्यवर्ती अफ्रीका महाद्वीप, मेडागास्कर, फिलिपीन्स में पैदा होता है। इसे मेवारी, निर्गुंडी, शिवाली, शिवारी, इन्द्राणी, शेफाली, सुरसा आदि नामों से जाना जाता है। इसके पत्रों का प्रयोग कषाय के रूप में बल्य, कृमिघ्न, दीपन, कफनिस्सारक, और श्लेषमघ्न के रूप में होता है। इसका प्रयोग चक्षुरोग, राजयक्ष्मा, शोथ, व्रणशोथ, श्वेतकुष्ट,

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

प्लीहावृद्धि, श्वासनलिका गत शोथ, दमा, संधिवात, बन्धकर्ण, एवं पैत्तिक बीमारियों में होता आरहा है (कीर्तिकर एवं वसु, १९३३; शर्मा, १९५६)। इस औषधि का भेषज प्रकृति विज्ञानीय अध्ययन मदन एवं नायर ने ११५९ में किया था, जिससे प्राप्त परिणाम अल्पोपयोगी हैं। इसी तथ्य को ध्यान में रखकर किया गया विशद अध्ययन इस निबन्ध में प्रस्तुत करने का प्रयास किया गया है।

सामग्री एवं विधि

निर्गुण्डी के पत्रों का संकलन काशी हिन्दू विश्वविद्यालय स्थित आयुर्वेदीय उद्यान से किया गया। हाथ तथा माइक्रोटोम से सेक्शन्स बनाकर उनका यथाविधि स्टेनिंग एवं माउन्टिंग की गयी। कोशाओं तथा कोशाभित्ति में प्राप्त होने वाले द्रव्यों का अध्ययन के (१९३८) एवं जानसन (१९४०) की विधि के आधारपर किया गया। इनकी मात्राओं का गणन वैलिस (१९५३) के आधार पर किया गया। इस प्रकार स्थूलदर्शी तथा सूक्ष्मदर्शी अध्ययन पेटियोल (पर्णवृन्त), पेटियोलूल (लघुवृन्त), मिडरिब (मध्यशिरा) लैमिना (पटल) आदि का अध्ययन किया गया।

परिणाम

इस अध्ययन से पता लगता है कि पेटियौल (पर्णवृन्त) तथा मिडरिब (मध्यशिरा) के आन्तरिक रचना के मूल, मध्य तथा ऊपरी भाग में बहुत से अन्तर पाये जाते हैं। मदन और नायर (१९५९) के अध्ययन की तुलना में यदि विचार किया जाय तो हम देखेंगे कि मिडरिब (मध्यशिरा) और पेटियोल (पर्णवृन्त) में पाये जाने वाले वास्कुलर आर्क के चारो ओर इस्क्लेरेनकाइमेटस (दृढ़ोतक बंडल) बैण्ड के होने का वर्णन है जो कि इस अध्ययन में नहीं पाया गया। ऐसे बैण्ड पर्णवृन्त के मूलसे बनना प्रारम्भ होकर शीर्ष भाग में धीरे धीरे सुस्पष्ट होने लगते हैं। मिडरिब (मध्यशिरा) केवल मूल में होते हैं। मध्य तथा शीर्ष भाग में कम होते हैं। मदन आदि (१९५९) ने मिडरिव (मध्यशिरा) के आभ्यान्तर भाग में होने वाले कोलेनकाइमा (स्थूलकोणोतक) के नीचे वाले तन्तुओं का कोई उल्लेख नहीं किया है उन्होंने पेटियोलूल (लघुवृन्त) का कोई अध्ययन नहीं किया है तथा लेमिना (पटल) में पाये जाने वाले हाइपोडर्मिस का कोई विवरण नहीं दिया है।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

PHARMACOGNOSTIC STUDY OF FRUITS OF MIMUSOPS ELENGI L. (BAKUL)

B. M. SHARMA*, PRATAP SINGH** AND C. K. ATAL***

(*From Regional Research Laboratory, Jammu Tawi.*)

[Received for publication on December 27, 1968]

Introduction

Mimusops elengi L. (N.O. Sapotaceae) is a tree upto 50 ft. tall growing in Deccan and Malaya Peninsula and cultivated in greater parts of India (Hooker, 1882) and is commonly known as *Maulsari* or *Bakul*. Its fruits are edible as well as used in indigenous system of medicine. They are used to fix loose teeth, to cure chronic dysentery, constipation, gonorrhoea, and are astringent to bowels (Watt, 1891 ; Kritikar and Basu, 1935 ; Chopra *et al.*, 1958 and Bedi-1964). According to Nadkarni (1954) the seeds contain fixed oil while the pulp of fruits is rich in sugars and saponins. The fruits are used to cure ulcers and wounds, to promote delivery and as antidote to snake poison.

Inspite of several medicinal properties attributed to the fruits of *M. elengi* L., its pharmacognostic study has so far not been made. The present study is, therefore, intended to bring out the salient morphological characters of these fruits so as to fill this important gap and facilitate identification of the fruits as a whole or in fragments.

Material and Method

The material for this study was collected from duly authenticated trees growing in Jammu. The dried fruits were softened by boiling in water. After thorough washing and dehydration, the fruits were embedded in parafin wax and microtome sections (10-15μ) cut. The sections were stained as per Johansen's (1940) schedule.

MACROSCOPIC CHARACTERS

The fruit is a berry with persistent calyx having five free sepals and sometimes with five free epicalyx lobes (Fig. 1). At maturity the fruits are 2.2-2.5 cm long and 1-1.5 cm broad, ovoid (Fig. 1), usually one (rarely two) seeded, green when unripe and yellow on ripening. Seeds are compressed, testa hard and shining, cotyledons broad, flat and embedded in fleshy albumen. A transection of the fruit shows that the pulpy rind is 5-8 mm thick embedding 0.8-1 cm long and 5 mm broad seed in the centre. In cross section the seeds give an oval outline with one end broader than the other (Fig. 2).

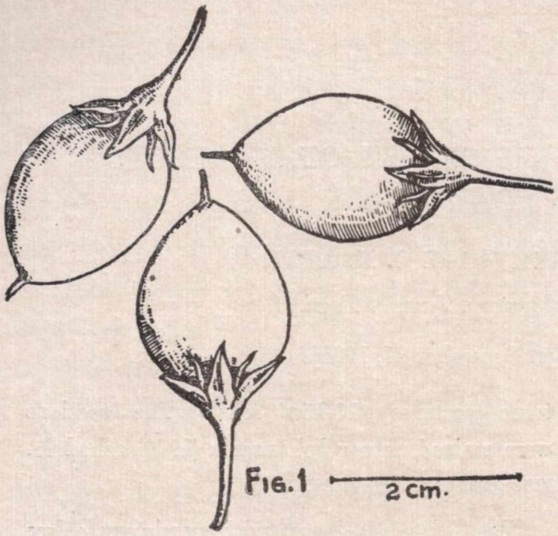
MICROSCOPIC CHARACTERS

Fruit Wall

A transection of the fruit reveals an exocarp, a mesocarp and an endocarp. The exocarp is protected by a cuticular covering approximately 5 μ thick. The epidermis is a single layer of columnar to squarish cells measuring on an average 15 $\mu \times 10 \mu$. Next 5-7 layers of tangentially flattened thin walled parenchymatous cells (10-25 μ long and 8-20 μ broad constitute the hypodermis (Fig. 3). They lack intercellular spaces and, like the epidermal cells, are

* Senior Scientific Assistant. ** Scientist 'C'. *** Assistant Director.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE



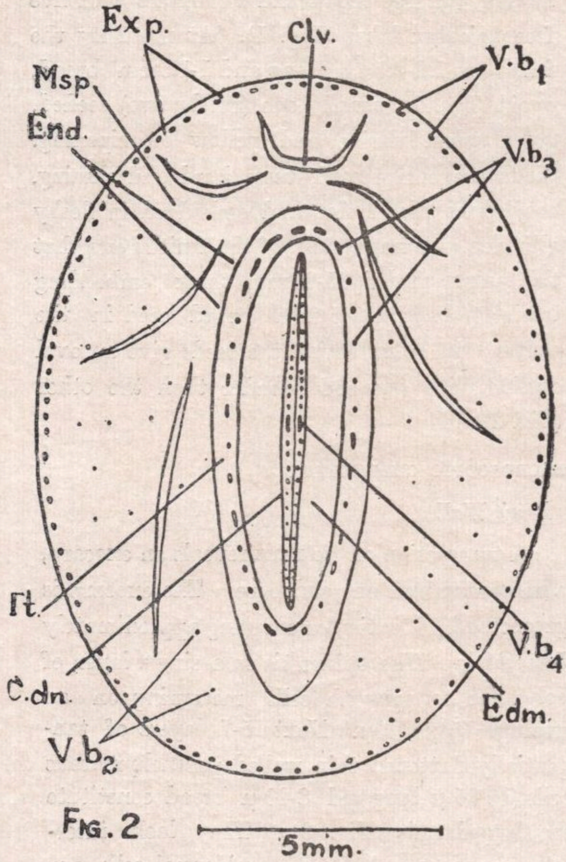


Fig. 1. Fruits of M. elengi
Fig. 2. Transection of fruit

filled with dense contents. The presence of secretory canals, lined with 5-7 epithelial cells, is a characteristic feature of this region. The latter is followed by several layers thick ring of stone cells interrupted by patches of invaginating parenchymatous cells. A ring of collateral vascular bundles delimits the outer tissues from the mesocarp (Figs. 2 & 4). Phloem of these vascular bundles (Fig. 4) is characterized by presence of laticiferous elements (Metcalfe & Chalk, 1950) and small patches of phloem fibres.

The mesocarp is a broad parenchymatous zone distinguished into an outer and an inner region. The cells of the outer region are 120-400 μ long and 40-130 μ wide while those of the inner are smaller, 40-120 μ in length and 20-100 μ in width. Although hexagonal, these cells tend to become oval (Fig. 5) as they approach the endocarp. Irregular distribution of numerous small vascular bundles and presence of a few elongated cleavages with tapering narrow ends (Fig. 2) are characteristic features of the mesocarp.

Majority of the cells of the exocarp and several cells in the region of mesocarp (Figs. 3, 4 & 5) are filled with masses of a rubber like substance (Metcalfe & Chalk, 1950). These masses one to each such cell, appear deep reddish shining bodies in unstained sections.

The endocarpic cells (Fig. 5) are oval, 40-60 μ long and 10-30 μ wide, thick walled but non-lignified.

Seed

The seed lies enclosed within the endocarp. The testa, 1 1.5 mm thick, is distinguished in a cross section into five distinct concentric regions. The outer most region upto 0.5 mm thick is composed of 12-15 layers of thick walled, polygonal isodiametric, sclerenchymatous cells (Fig. 6) ranging between 15-65 μ in diameter.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

The cells of the subsequent four successive zones are thin walled and parenchymatous. Outermost of these is a broad ring of rounded to oval cells, 20-60 μ long and 10-40 μ wide; with conspicuous intercellular spaces and dense cell contents. The cells of the next zone are horizontally placed and tangentially flattened with dense contents which in nature are similar to the cell contents of the preceding region. They are 40-130 μ long and 20-40 μ wide, compactly arranged and lack intercullar spaces. Next 2-3 layers of horizontlally placed polygonal cells with thick deep reddish contents comprise the fourth zone. The cells of this layer are 20-40 μ long and 15-25 μ wide. Nature and consistency of the cell contents is similar to that of the rubber like substance found in the cells of the fruit wall. Vascular bundles of the testa (Fig. 2) lie in a ring in close proximity to the cells of this layer. The innermost or the fifth zone is composed of a few layers of rounded to oval cells (12-15 μ diameter), devoid of cell contents and enclosing intercellular spaces.

The vascular bundles of the testa are broader than long. Structure of one such vascular bundle in transverse section is shown in Fig. 9. Vascular tissue is composed of well developed thick walled xylem vessels, a few fibres, and the usual phloem tissues. Cell contents of the adaxial parenchyma of the bundles are identical to those of the fourth zone of the testa, while the abaxial parenchyma has contents similar to those in the cells of the second and third layers of testa. A thin perisperm comprising of 1-4 layers of thin walled cells (25-75μ long and 20-30μ wide) separates the testa from endosperm (Fig. 6). The cells of the endosperm (Fig. 7) are thin walled, parenchymatous, polygonal, smaller at the periphery and larger towards the centre. They are 20-125μ long and 20 to 80μ wide. The epidermal cells of cotyledons are columnar to squarish in cross section while those of the ground tissue are rounded to oval and enclose air spaces. A number of fine vascular strands with poorly developed elements are seen lying along the longitudinal median of the transection of the cotyledon (Fig. 2). Structure of one such vascular strand from the middle region of the cotyledon is represented in Fig. 8.

Powder of the Fruit

The representative structures of an eighty mesh powder, as examined under the microscope, are shown in Fig. 10. Fragments of fibres (*a*), sclereids (*b*), stone cells (*c*), groups of thick walled cells, (*d*), masses of rubber like bodies (*e*), groups of parenchymatous cells with and without contents (*f*) and fragments of spiral and scalariform vessels (*g*), are clearly made out. These structures, particularly (*b*), (*c*) and (*e*) can be helpful in identifying the drug in powder form.

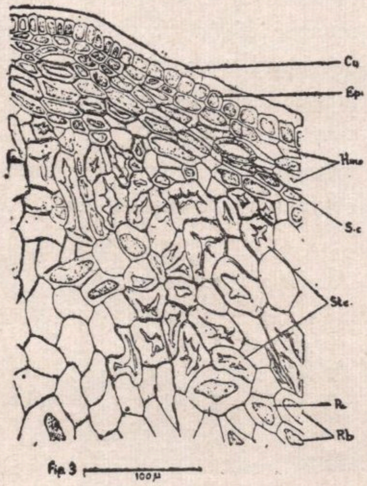
Summary

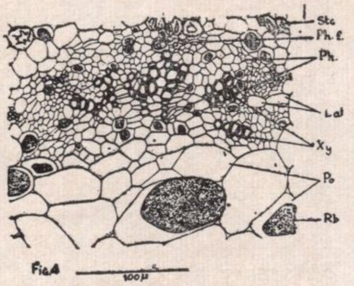
The fruits of *Mimusops elengi* commonly called maulsari or *Bakul* are used in indigenous system of medicines for various ailments. The unripe and ripe fruits and seeds are all used. The anatomical characters of these fruits in transverse section and in powder form have been described. The structure of the exocarp, mesocarp and endocarp of the fruit and of testa, endosperm and cotyledons in the seed can be helpful in quick indentification of the drug.

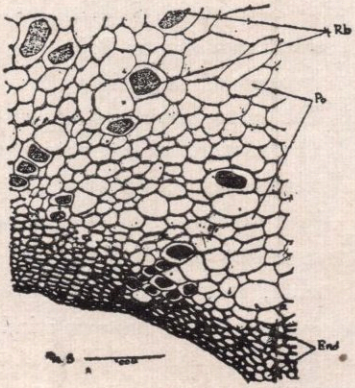
ABREVIATIONS

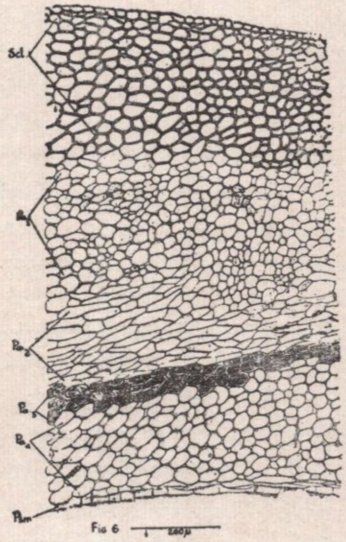
Cdn.-Cotyledon, Clv.-Cleavages, Cu-Cuticle. Edm.-endosperm, End-endocarp, Epi-epidermis. Exp-Exocarp, Gt.-ground tissue, Hms-hypodermis.

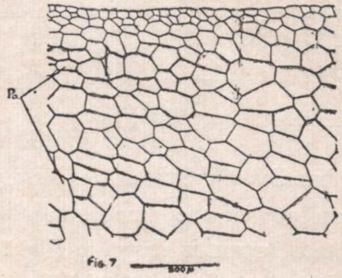
AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE











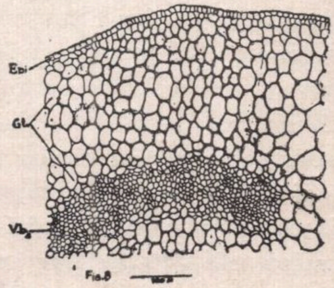
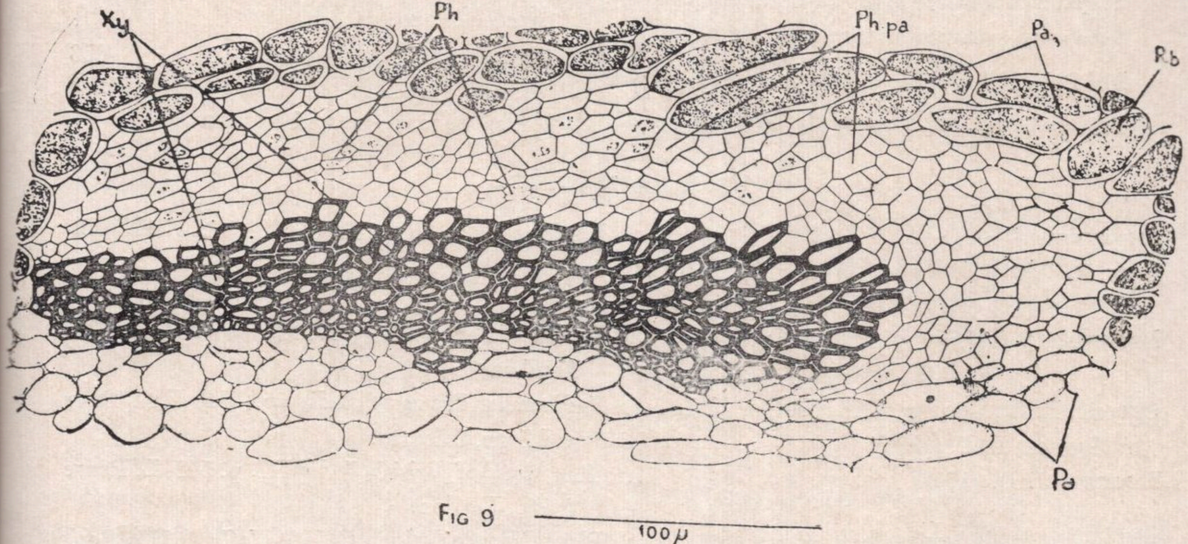


Fig. 3. Hypodermis.
Fig. 4. Mosocarp.
Fig. 5. Endocarp.
Fig. 6. Seeds-Cross section-perisperm.
Fig. 7. Endosperm.
Fig. 8. Vascular bundle of cotyledon.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE



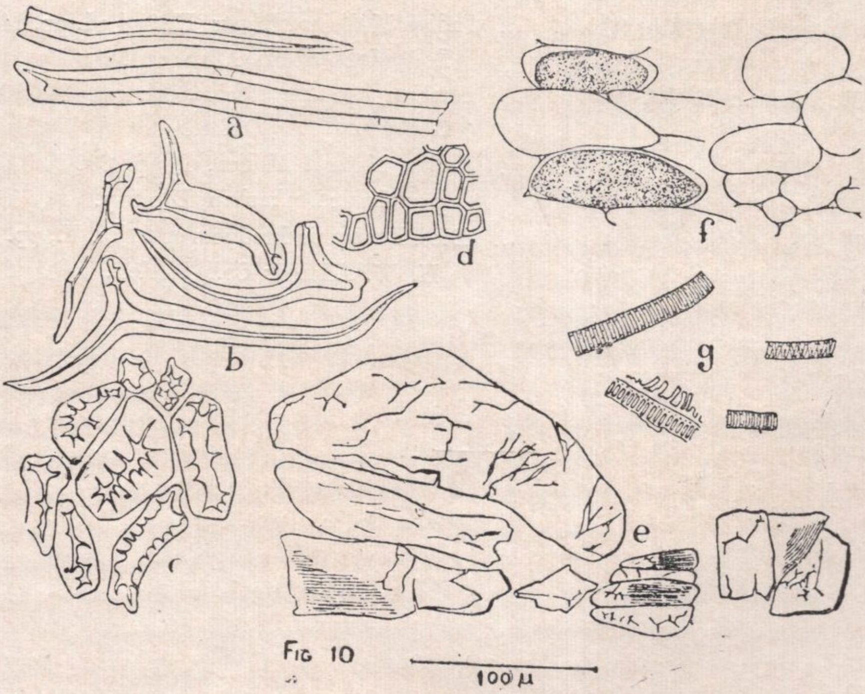


Fig. 9. Vascular bundle of testa.

Fig. 10. Microscopic picture of 80 mesh powder.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Lat-Latiferous elements, Msp-mesocarp; Pa-parenchyma ; Pa-, Pa2, Pa3-, Pa4- Successive parenchymatous zones of testa. Phf-Phloem fibres, Ph pa-phloem parenchyma Psm-perisperm, Rb-rubber-like cell contents, Sc.-secretory canal, ++ Scl-Sclerenchyma. Stc.-stone cells, Tt-Testa, Vb1-Vascular bundles in exocarp. VB2-vascular bundles in mesocarp, Vb3 Vascular bundles in testa, Vb4-Vascular bundle in cotyledons, Xy-xylem.

REFERENCES

ANONYMOUS (1962) ... Wealth of India, VI p. 383-85, C.S.I.R., New Delhi.

BEDI, R. (1964) ... Indian Farming, 14(5). pp. 23-24 I.C.A.R., New Delhi.

BRANDIS, D. (1921) ... Indian Trees, p. 425, La Constrable and Co., London.

CHOPRA, R. N., CHOPRA, I. C., HANDA, K. L. & KAPOOR, L. D. (1958) ... Indigenous Drugs of India, p. 514, U.N. Dhar and Sons, Calcutta.

HOOKER, J. D. (1882) ... The Flora of British India III, p. 548, L. Reeve & Co., London.

JOHANSEN, D. A. (1940) ... Plant Microtechnique p. 118, McGraw Hill Book Co., New York.

KIRTIKAR, K. & BASU, B. D., (1935) ... Indian Medicinal Plants, II, 2nd ed. pp. 1494-96, Lalit Mohan Basu, Allahabad.

METACALFE, C. R. & CHALK, L. (1950) ... Anatomy of the Dicots, II, pp. 871-76, The Clarendon Press, Oxford.

NADKARNI, A. K. (1954) ... Indian Materia Medica, I, pp. 800-802, Dhootpapeshwar Prakashan, Bombay.

WATT, G. (1891) ... Dict. Economic Products of India, V., pp. 249-51, H. W. Allen & Co., London.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

हिन्दी सारांश

मौलश्री के फल का औषधि प्रकृति विज्ञानीय अध्ययन

बी० एम० शर्मा, पी० सिंह एवं सी० के० अटल
(क्षेत्रीय अनुसंधान प्रयोगशाला, जम्मू)

प्रस्तावना

मौलश्री या बकुलके वृक्ष ५० फुट या इससे भी अधिक लम्बाई के होते हैं। यह दक्षिण में दक्कन के पठार, मलय क्षेत्र एवं भारतीय भूभाग के अन्य क्षेत्रों में पाया जाता है (हूकर १८८२)। इसे बकुल तथा लेटिन में मिमूसोप्स एलेंगाई एल कहते हैं। इसके फल खाये जाते हैं तथा आयुर्वेदीय चिकित्सा में इनका बहुशः प्रयोग किया जाता है। इसका उपयोग हिलते हुए दांतों को सुदृढ़ करने के लिए, जीर्ण अतिसार, मलावरोध, मूत्रकृच्छ आदि रोगों में करते हैं (वाट, १८९१; कीर्तिकर और बसु, १९३५; चोपड़ा आदि, १९५८ तथा बेदी, १९६४) नादकर्णी (१९५४) के आधार पर इसके बीज में तेल तथा बीजमज्जा में शर्करा तथा सेपोनीन होने का उल्लेख है। इसके फलों का प्रयोग भारतीय चिकित्सा पद्धति के आधार पर घावों तथा व्रणों को भरने के लिए, आसानी से बच्चा पैदा कराने के लिए तथा सर्पविष के प्रतिकारार्थ करते हैं। उपर्युक्त तथ्यों को ध्यान में रखकर इसका औषधि प्रकृति विज्ञानीय अध्ययन, जो पहले नगण्य ही रहा है, इस निबन्ध में प्रस्तुत करने का प्रयास किया गया है।

सामग्री एवं विधि

इस अध्ययन के लिए जम्मू प्रदेश में उगने वाले मौलश्री के वृक्षों से फलों को संग्रहीत किया गया। सूख फलों को उबले हुए जल में रखकर कोमल बनाया गया, उन्हें ठीक से साफ कर तथा विधिवत निर्जल कर, पैराफीन वैक्स में रखकर अन्तःस्थापित किया गया। माइक्रोटोम की सहायता से १० से १५ म्यू के सेक्शन्स काट कर जानसन (१९६०) की विधि से स्टेन करके सूक्ष्मदर्शी अध्ययन किया गया।

इससे फल के वाह्यदलपुंज वर्तमान रहते हैं तथा पांच वाह्य दल स्वतंत्र रूप से पाये जाते हैं। अर्त फल परिपक्वावस्था नें २ से २.५ सेन्टीमीटर लम्बे और १ से १.५ सेन्टोमीटर चौड़ें, अण्डाकार होते हैं। एक या दो बीज इनमें होता है। अपरिपक्वावस्था में फल हरे तथा परिपक्वावस्था में पीले होते हैं। छिलका कड़ा तथा चमकदार होता है। दल चौड़ें और चपटे होते हैं।

इन फलों की अन्तःरचना का उल्लेख अनुप्रस्थ तथा चूर्ण के आधार पर किया गया है। फल तथा बीजचोल की वाह्यभित्ति, मध्यभित्ति एवं अन्तर्भित्ति की रचना, बीज के भ्रूणपोश तथा बीजपत्र का विशेष विवरण प्रस्तुत किया गया है। इससे इस भेषज के शीघ्र अभिज्ञान में प्रचुर सहायता मिल सकती है।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4 : 2, 1970.

PHARMACOGNOSTICAL STUDIES ON STEPHANIA GLABRA MIERS (RAJPATHA)

S. PRASAD* AND A. K. WAHI**

(*From the Department of Pharmaceutics, Banaras Hindu University, Varanasi—5*)

[Received for publication on March 7, 1969]

Introduction

Stephania glabra (family-Menispermaceae) is a large climbing shrub which is distributed widely in tropical and temperate Himalayas ascending to an altitude of 7000 feet above the sea level, from Simla to Sikkim, Khasia hills, Assam and Tenasserim. It is commonly known as Rajpatha, Purha and Gindaru and is used as substitute for *Cyclea peltata* and *Cissampelos pareira*. In the indigenous system of medicine it has been used in the treatment of pulmonary tuberculosis, asthma, dysentery, fever and intestinal complaints (Kirtikar and Basu, 1933 ; Sharma, 1956).

The chemical investigation of this plant was undertaken by several investigators and in all eighteen alkaloids namely palmatine (Chaudhary *et al.*, 1952; Wa *et al.*, 1967), tetrahydropalmatine (Chaudhary *et al.*, 1952), gindaricine (Chaudhary and Siddiqui, 1950), stepharine and pronuciferine (Cava *et al.*, 1964), hyndarine and cycleanine (Rabinovich *et al.*, 1966 ; Shchelchkov *et al.*, 1966), columbamine, jatrorhizine, magnoflorine, alkaloid A and B (Wa *et al.*, 1967), alkaloid A and B were later shown to be dehydrocorydalmine and stepharanine (Doskotch *et al.*, 1967), stepharotine (Manske, 1967), and five alkaloids—$C_{19}H_{18}O_2N$, m.p. 81° ; $C_{21}H_{25}O_4N$, m.p. 183° ; $C_{20}H_{25}O_4N$, m.p. 154° ; $C_{19}H_{21}O_4N$, m.p. 205° and a base as hydrochloride m.p. 253° (Manske, 1968) have been isolated. However, in pharmacognostical field no work is on record on this species, therefore a detailed study was undertaken.

Materials and Methods

Dry and preserved whole plants of *Stephania glabra* were obtained from Survey Officer, Survey of Medicinal Plants, Hardwar. Hand and microtome sections were taken, stained and mounted in usual manner. Cell content and cell wall structure studied according to the procedure described elsewhere (Kay, 1938 ; Johansen, 1940). Methods for determining the quantitative values were same as described by Wallis (1953). Fluorescence analysis was done according to the procedure described by Chase and Pratt (1949).

MACROSCOPICAL CHARACTERS

Tuber

The tubers vary in shape and size considerably. They are round, sub-spherical, pear shaped or irregularly oblong in shape and show rough surface with lenticels and few markings of roots which are fibrous. Tubers appear whitish yellow in colour, when young, and dark brown when old and dry.

Stem

The stem is cylindrical with smooth surface and green in colour, when young, but mature

* Prof. and Head of the Department. ** Lecturer.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

dry stem shows longitudinal ridges and furrows running all over and appears greyish brown in colour. Market sample shows pieces upto 1.5 cm in thickness with cord like appearance and fibrous fracture.

Leaf

The leaves are 4-12 cm in length and 4-10 cm in breadth. They are simple, peltate, acute, entire, glabrous, cordate with palmate reticulate divergent venation, petiolate with petiole 3-6 cm long.

MICROSCOPICAL CHARACTERS

The early stages of the tuber were studied from the material 0.5 inches thick. In early stages tuber shows a cork consisting of 8-10 layers of cells. The cork is followed by a wide zone of ground tissue composed of parenchymatous cells, the cells of the outer region of which are larger as compared to those of the inner region. The middle and the inner regions of the ground tissue show several scattered vascular bundles and a few vessels. Some of the vascular bundles show a single radial row of small groups of xylem vessels on the inner side and phloem elements on the outer side, whereas the smaller bundles show three to four xylem elements in groups on the inner side and few phloem elements on the outer side. (Plate I, Fig. 1, 2).

As the tuber increases in thickness, the cork as well as the ground tissue increases in thickness. In later stages, some of the cells of the ground tissue of the outermost region become thickwalled, lignified and are thus converted into stone cells. The stone cells are mostly arranged in groups and the individual cells vary in shape and size and show simple pits on their walls. The scattered bundles of the ground tissue also develop more and more with increase in thickness of the tuber and at places, the xylem strands, due to parenchymatisation, get divided into two to three radiating arms. The innermost region of the ground tissue shows a number of vascular bundles arranged in a ring, showing radial arrangement with xylem on the inner side and phloem on the outer side. These vascular bundles also show a tendency of parenchymatisation. The medullary rays alternate with the vascular bundles and are 5-20 cells wide (Plate II, Fig. 3,4)

The phloem consists of sieve tubes, companion cells and phloem parenchyma while xylem consists of vessels, tracheids, fibres and xylem parenchyma. The vessels are long, narrow and drum shaped and show transverse to oblique perforation rims (Plate II, Fig. 5*a-d*). The tracheids are long, narrow with pointed to blunt ends and vary in shape (Plate II, Fig. 5*e-g*). Both vessels and tracheids show simple pits on their walls. Fibres are long with pointed ends (Plate II, Fig. 5*m-n*) and xylem parenchyma are rectangular in shape (Plate II, Fig. 5 *o-p*). All the elements of xylem are lignified. Some of the cells of the outermost region contain acicular crystals of calcium oxalate and most of the cells of the ground tissue contain starch grains.

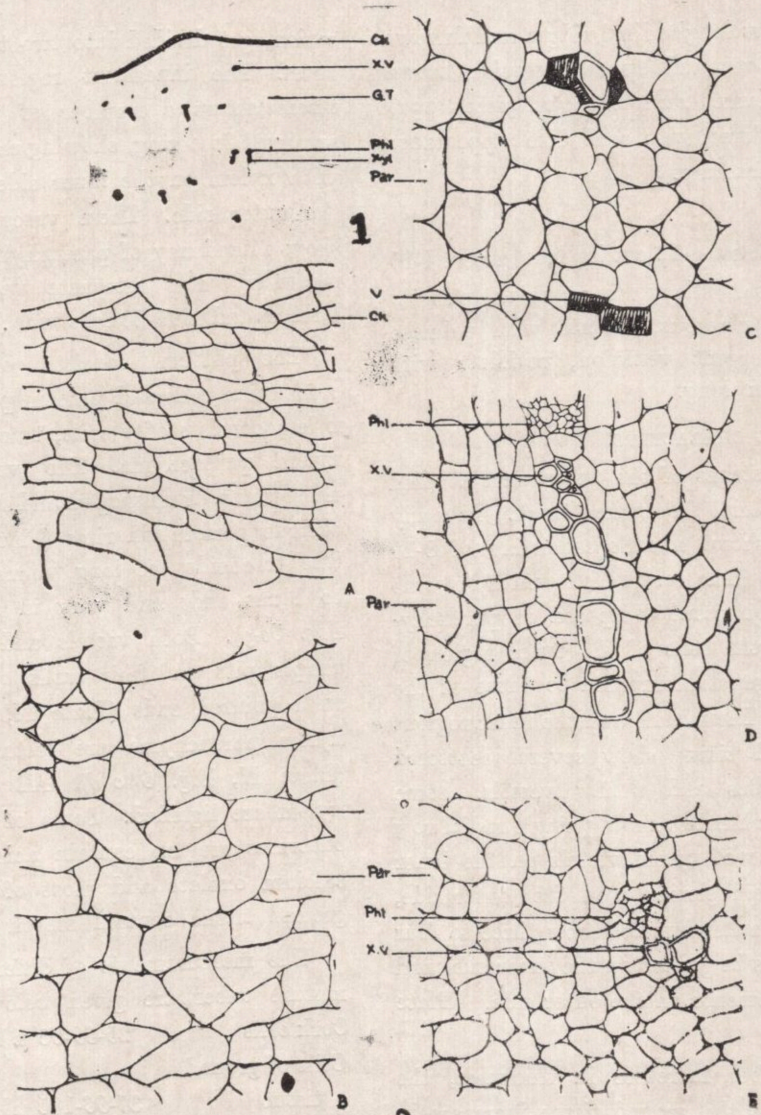
The measurements of different cells of the mature tuber are given below :

Cork cells	25-*59*-96 μ by 11-*33*-56 μ
Cells of ground tissue	37-*96*-185 μ by 25-*62*-98 μ
Stone cells	39-*148*-278 μ by 25-*60*-90 μ
Vessels	89-*222*-360 μ by 68-*115*-185 μ
Tracheids	45-*110*-152 μ by 6.5-*14*-26 μ
Fibres	460-*620*-790 μ by 8-*17*-5-28 μ
Xylem parenchyma	42-*56*-78 μ by 30-*48*-65 μ

Stem

The young stem shows a single layered epidermis followed by 6-10 layers of parenchymatous cortex. There are generally 8 vascular bundles arranged in a ring and the vascular

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE



2

PLATE—I

Fig. 1. Part of T. S. of early stage of mature tuber (diagrammatic), × 8.

Fig. 2. Part of T. S. of Fig. 1 showing cellular details × 220.

A Cork and ground tissue

B Outer region of tuber showing ground tissue

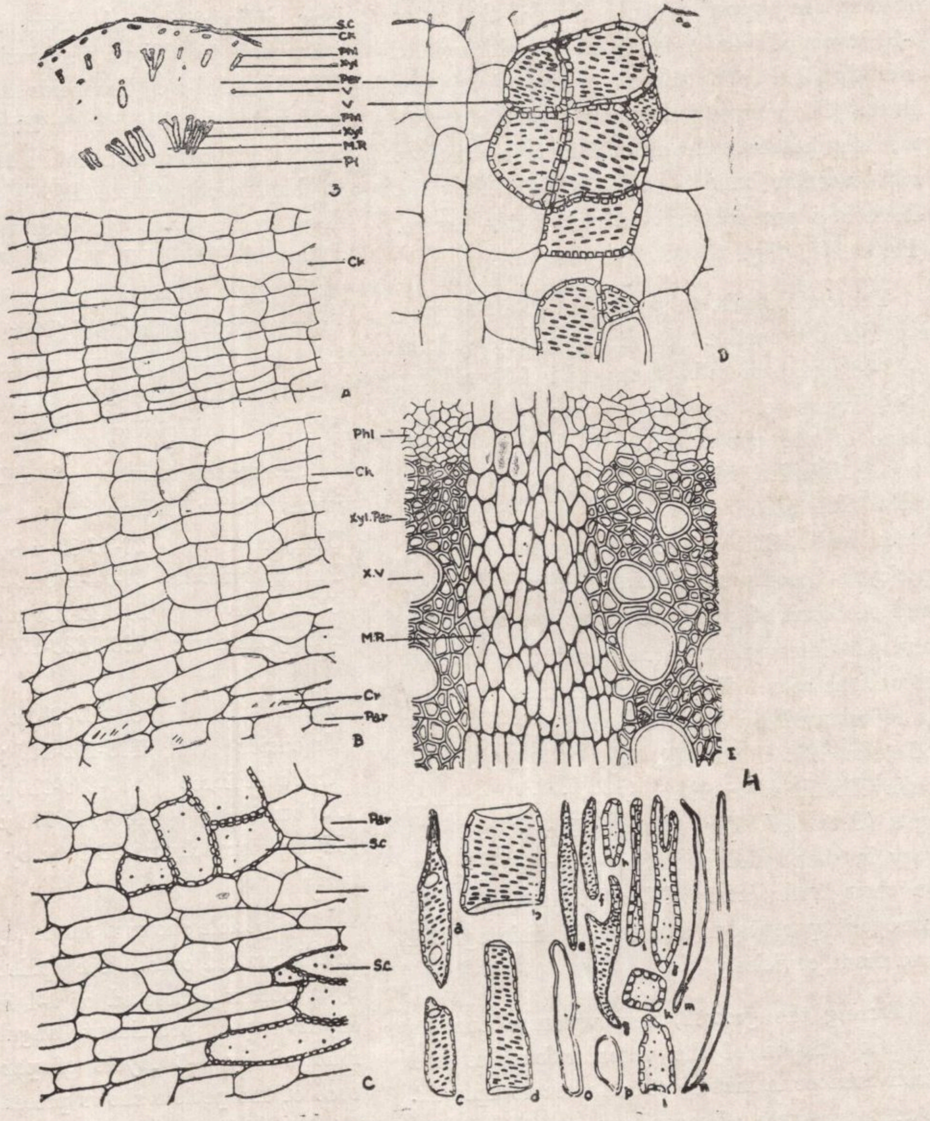
C Ground tissue with scattered vessels

D-E Ground tissue showing arrangement of vascular bundle

ABBREVIATION

CK, Cork ; G. T., Ground tissue ; Par, Parenchyma ; Phl. Phloem ; V, Vessel ; Xyl, Xylem ; X-V, Xylem vessel ; Xyl. par, Xylem parenchyma.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE



PLATE—II

Fig. 3. Part of T. S. of mature tuber (diagrammatic) × 2

Fig. 4. Part of T. S. of Fig. 3 showing cellular details × 285

- A Cork
- B Cork and outer most ground tissue
- C Ground tissue showing stone cells
- D Ground tissue showing vessels
- E Innermost region of tuber showing arrangement of vascular bundles

Fig. 5. Isolated elements of the tuber × 110

a-d Xylem vessels *m-n* Xylem fibres
e-g Tracheids *o-p* Xylem parenchyma
h-l Stone cells

ABBREVIATION

Ck, Cork ; Cr, Crystals ; G.T., Ground tissue ; M.R., Medullary ray ; Par, Parenchyma ; Phl. Phloem ; Pi. Pith ; S.C., Stone cell ; V, Vessel ; Xyl. Xylem ; X.V. Xylem vessel ; Xyl. par, Xylem parenchyma.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

bundles are capped by a pericycle, the outer 5-10 layers of cells of which become thickwalled and lignified and form sclerenchymatous fibres. The inner 3-6 layers of pericycle remain parenchymatous. The medullary rays alternate with vascular bundles and are 4-9 cells wide. There is a parenchymatous pith in the centre. (Plate III, Fig. 6, 8).

The cork cambium arises in the outermost layer of the cortex. In mature stem, cork is 6-*12*-18 layers of cells thick and is followed by 6-14 layers of parenchymatous phelloderm. Some of the phelloderm cells become thick-walled, lignified and are converted into stone cells. The stone cells show simple pits on their walls. The sclerenchymatous tissue of pericycle become more thickened and lignified and the band of pericyclic fibres get separated and the intervening parenchyma is converted into stone cells. Thus sclerenchymatous tissue is represented by fibres alternating with band of stone cells (Plate III, Fig. 7, 9A-B). The pericyclic fibres are long, narrow with pointed ends (Plate IV, Fig. 12*a-c*). The stone cells vary in shape and size and show simple pits on their walls (Plate IV, Fig. 11 *a-g*). The pericyclic parenchyma often get disintegrated and from cavities.

During the growth, new vascular bundles arise by fission of the vascular bundles and their number in mature stem increases upto 12. Due to pressure of secondary growth, phloem tissue under the arch of pericyclic fibres collapse and form bands of ceratenchyma (Plate III, Fig. 7, 9B). The phloem consists of sieve tubes, companion cells and phloem parenchyma while xylem consists of vessels, tracheids, tracheid fibres, fibres and xylem parenchyma, all traversed by medullary rays (Plate IV, Fig. 10). The medullary rays are 3-*15*-20 cells wide. The xylem vessels vary in shape and are long cylindrical and drum shaped showing transverse to oblique perforation rims. (Plate IV, Fig. 11*h-n*). Tracheids are long, narrow with pointed to blunt ends (Plate IV, Fig. 12*j-l*). Tracheid fibres are also quite long with pointed to blunt ends (Plate IV, Fig. 12*m-n*). The fibres are mostly not very long but few are greatly elongated (Plate IV, Fig. 12 *d-i*). The xylem parenchyma cells are rectangular to oval in shape and are thickwalled (Plate IV, Fig. 12 *o-p*). All the elements of xylem are simple pitted and tracheids and fibre tracheids also show sclariform thickening on their walls.

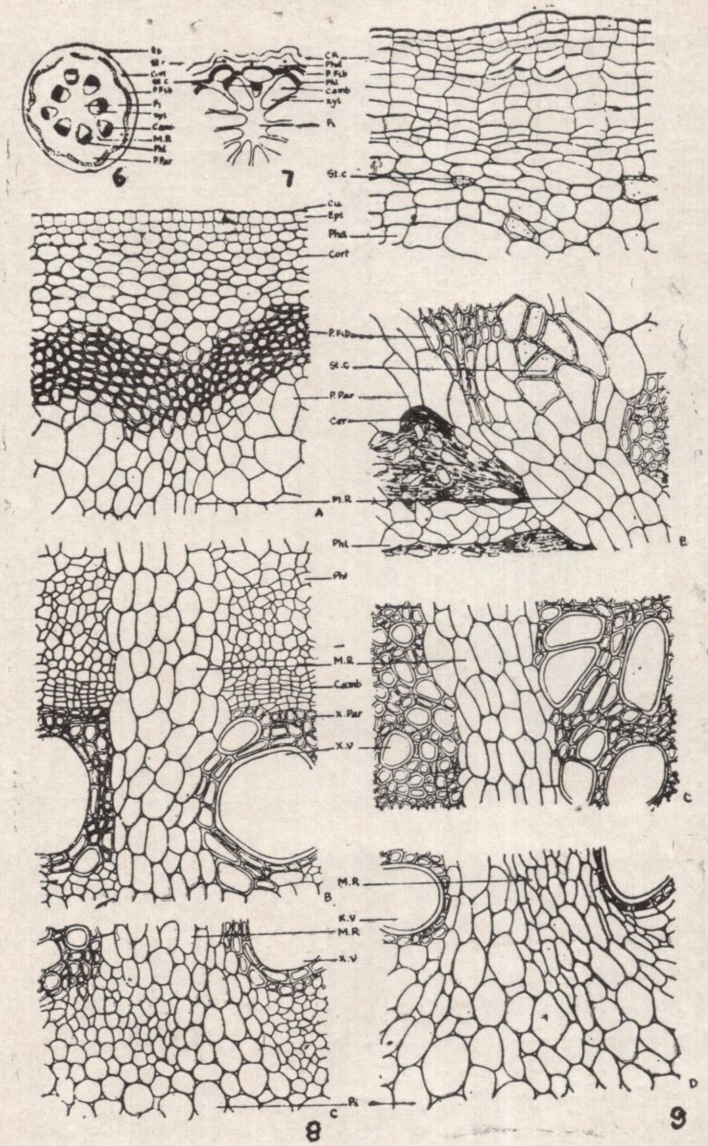
The measurements of different cells and tissues of the mature stem are given below :

Cork cells	26-*56*-82 μ by 7.5-*26*-44 μ
Phelloderm cells	37-*74*-100 μ by 15-*30*-48 μ
Stone cells	23-*133*-230 μ by 18.5-*59*-92μ
Pericyclic fibres	769-*1228*-1776 μ by μ 14.8-*22*-30 μ
Vessels	89-*237*-385μ by 74-*133*-222 μ
Tracheids	118-*192*-237 μ by 7.4-*18*-30μ
Tracheid fibres	239-*270*-310 μ by 14.8-*22*-32μ
Xylem fibres	459-*622*-770 μ by 14.8-*30*45μ
Xylem parenchyma	58-89 μ by 30-*44*-59 μ

Leaf

The petiole shows a single layered epidermis of thickwalled cells. The epidermis is followed by a cortex composed of 2-4 layers of collenchyma with prominent angular thickening, followed by 4-6 layers of parenchyma. The base of the petiole shows presence of pericyclic fibres, which start developing from the middle region where they are seen in small groups in the form of a discontinuous ring but in the apical region they become continuous surrounding the vascular bundles. There are generally 8-9 vascular bundles arranged in a ring, separated by medullary rays. The large central pith consists of parenchymatous cells which are more or less isodiametric in shape (Plate V, Fig. 18-20).

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE



PLATE—III

Fig. 6. T.S. of young stem (diagrammatic) ×9

Fig. 7. T.S. of mature stem (diagrammatic) ×8

Fig. 8. Part of T.S. of Fig. 6 showing cellular details X 150
- A Epidermis, Cortex and pericycle
- B Phloem and outer xylem
- C Inner xylem and pith

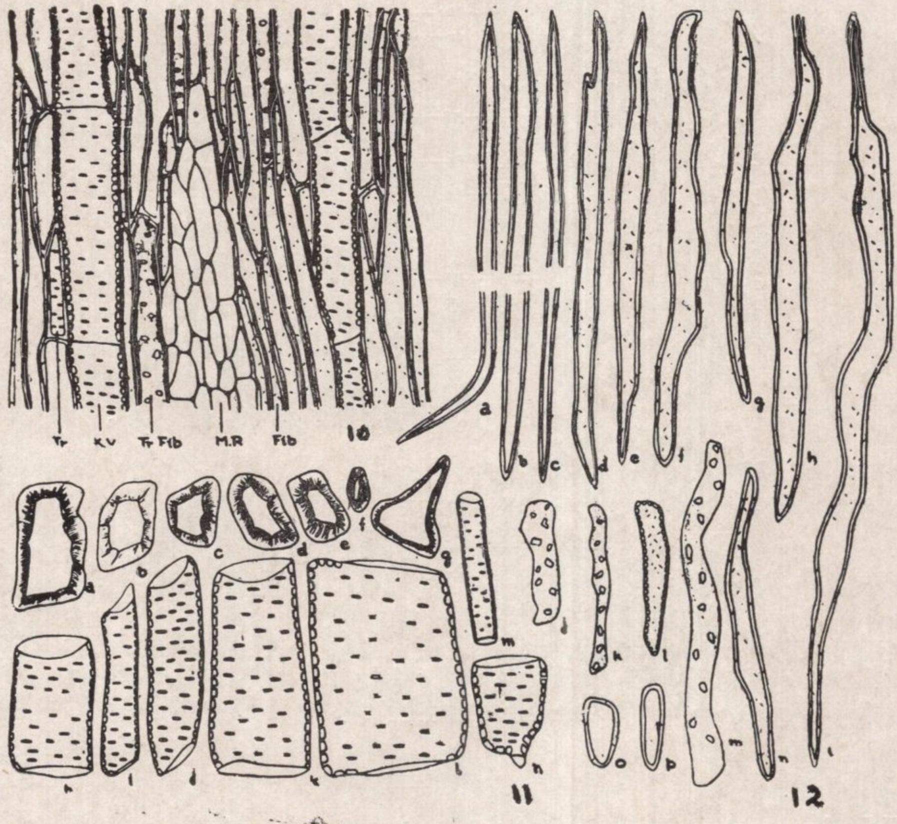
Fig. 9. Part of T.S. of Fig. 7 showing cellular details × 150
- A Cork and phelloderm
- B Paricycle and phloem
- C Outer xylem
- D Inner xylem pith

ABBREVIATION

Camb. Cambium ; Cer. Ceratenchyma ; C.K. Cork ; Cort, Cortex ; Cu. Cuticle ; Epi. Epidermis ; M.R. Medullary ray ; P. Fib. Pericyclic fibre ; Phd. Phelloderm ; Phl. Phloem ; Pi. Pith ; P. Par. Pericyclic parenchyma ; St. C. Stone cell ; X. Par. Xylem parenchyma ; X.V. Xylem vessel ; Xyl. Xylem.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

The midrib shows a single layered epidermis, the cells of which form papilla like outgrowth in many cases on the ventral side but cells forming papilla are much less on the dorsal side. Epidermises on both the sides are followed by 2-3 layers of slightly thickwalled collenchymatous cells. Below the collenchyma is a zone of parenchyma, 5-8 cells thick. The parenchymatous cells of the dorsal side are bigger than those on the ventral side. The central region of the midrib is occupied by a well developed vascular bundle with phloem on the dorsal and xylem on the ventral side. The phloem consists of sieve tubes, companion cells and large phloem parenchyma while xylem consists of vessels, tracheids and xylem parenchyma. Prismatic crystals of calcium oxalate are present in some of the collenchymatous and parenchymatous cells of the cortex (Plate V, Fig. 13, 14).



PLATE—IV

Fig. 10. Tangential section of stem through xylem region × 220.

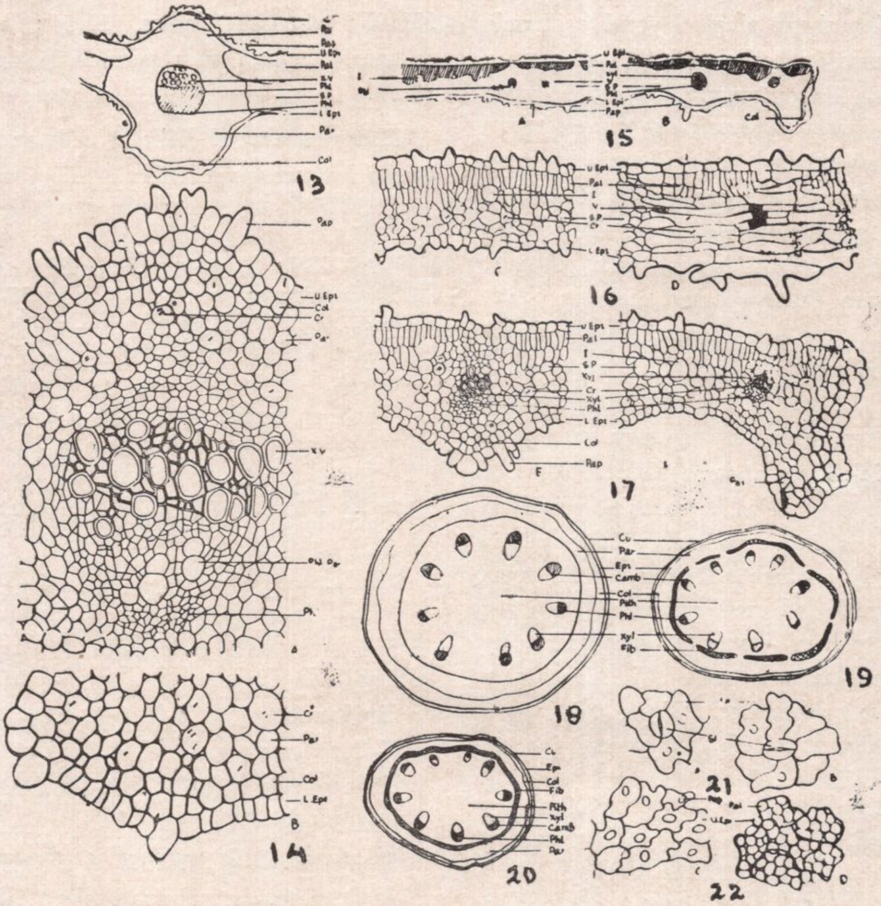
Fig. 11. Isolated elements of stem
a-g Stone cells × 220
h-n Xylem vessels × 110

Fig. 12. Isolated elements of stem × 220
a-c Pericyclic fibres
d-i Xylem fibres
j-l Tracheids
m-n Tracheid fibres
o-p Xylem parenchyma

ABBREVIATION

Fib. Fibre ; M.R. Medullary ray ; Tr. Tracheid ; Fib. Tracheid fibre ; X.V. Xylem vessel.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE



PLATE—V

Fig. 13. T.S. of midrib (diagrammatic) × 63

Fig. 14. Part of T.S. of Fig. 13 showing cellular details × 225.
- A Upper epidermis to phloem
- B Cortex and lower epidermis.

Fig. 15A-B T.S. of lamina (diagrammatic) ×63

Fig. 16C-D Part of T.S. of Fig. 15A showing cellular details × 150.

Fig. 17E-F Part of T.S. of Fig. 15B showing cellular details × 150

Fig. 18. T.S. of petiole, basal region (diagrammatic) × 16

Fig. 19. T.S. of petiole, middle region (diagrammatic) × 16

Fig. 20. T.S. of petiole, apical region (diagrammatic) × 16

Fig. 21A-B Surface view of the lower epidermis showing stomata × 225.

Fig. 22C-D Surface view of upper epidermis showing palisade and papillose × 225.

ABBREVIATION

Camb. Cambium ; Col. Collenchyma ; Cr. Crystal ; Cu. Cuticle ; Epi. Epidermis ; Fib. Fibre ; I, Idioblast ; L. Epi. Lower epidermis ; Pal. Palisade ; Pap. Papillose, Par. Parenchyma ; Phl. Phloem ; Pi. Pith ; S.P. Spongy parenchyma ; St. Stomata ; U.Epi. Upper epidermis ; V. Vessel ; X.V., Xylem vessel; Xyl, Xylem.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

The lamina shows single layered epidermis on both the sides, the cells of which in most cases show papillose like outgrowth. In surface view cells of the upper epidermis show more wavy walls than those of the lower epidermis. Stomata are found only on the lower surface of the leaf and are of ranunculaceous type. Below the upper epidermis is 1-2 layers thick palisade, cells which are closely packed and are continuous except over the veins which are transcurrent. The spongy mesophyll is represented by 3-5 layers of cells which vary in shape and are loosly arranged. The spongy mesophyll also shows idioblasts at some places. Some of the spongy mesophyll cells contain prismatic crystals of calcium oxalate. Mesophyll is traversed by large number of veins. Small veins are transcurrent and are represented by a few xylem and phloem elements, surrounded by colourless parenchyma which is continuous upto the two epidermises. Bigger veins show structure similar to midrib. At extreme margin of leaf, the palisade cells are replaced by thick-walled, circular type of spongy parenchyma (Plate V, Fig. 15-17, 21, 22).

The average qnantitative values of the leaves are : palisade ratio, 9.55 ; stomatal number, 281.05 ; stomatal index, 17.54 ; vein-islet number, 1.73 ; vein termination number, 13.72.

Measurements of different cells and tissues of the leaf are given below

Petiole	
Epidermis	11-*18*-30 μ by 11-*16*-22 μ
Parenchyma cells	37-*56*-75 μ by 37-*59*-68 μ
Pith cells	30-*70*-111 μ by 30-*55*-92 μ
Lamina	
Upper epidermis	18.5-*21*-23 μ by 11-*13*-15 μ
Lower epidermis	11-*14*.5-18.5 μ by 7.4-*9.4*-11 μ
Palisade	14-*21*-30 μ by 3.5-*5*-7.5 μ
Spongy parencyma	5.5-*10*-15 μ by 7-*12*-18.5 μ
Midrib	
Dorsal side	
Epidermis	15-*20*.5-26 μ by 15-*18*-22 μ
Collenchyma	11-*24*-33.5 μ by 7.5-*16*-26 μ
Parenchyma	18.5-*27*-5-34 μ by 15-*20*-26 μ
Ventral side	
Epidermis	15-*20*.*5*-26 μ by 11-*17*-22 μ
Collenchyma	11-*16*-22 μ by 7.5-*12*.5-18 μ
Parenchyma	7-*12*-19 μ by 8-*14*-20 μ

FLUORESCENCE ANALYSIS

Reagent	Tuber	Stem	Leaf
Powder as such	Yellowish orange	Brown with orange tinge	Light brown
Powder mounted in nitrocellulose	Lamon yellow	Browinsh	Dirty orange
Powder treated with 1N NaOH in methanol	Brownish with violet tinge	Dark brown	Dark brown
Powder treated with 1N NaOH in methanol and mounted in nitrocellulose	Bright yellow	Brownish with yellow tinge	Brown

Summary

In the present investigations pharmacognostical studies on the tuber, stem and leaf of *Stephania glabra* has been carried out along with the fluorescence characteristics.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

REFERENCES

Cava, M.P., Nomura, K., Schlessinger R. H., Buck, K. T. and Donglas, B., Raffanf, R. F., and Weisbach, J. A. (1964) ... A chemical determination of the absolute configuration of Aporphines, the reductive cleavage of proaporphine, Chem. Industry, *7*, 282.

Chase, C. R. and Pratt, R. (1949) ... Fluorescence of Powdered Vegetable Drugs with particular reference to development of a system of identification, J. Amer. Pharm. Ass., (Sci. Edn.), *38*, 324.

Chaudhary, G. R. and Siddiqui, S. (1950) ... The alkaloids of Indian Stephania : Part—I Isolation of three crystalline alkaloids from the tubers of S. glabra Miers, J. Sci. Ind. Res., *9*, (4), 78.

Chaudhary, G. R., Sharma, V. N., and Dhar, M. L. (1952) ... Alkaloids of S. glabra. Identity of gindarine and ginderinine with tetra-hydropalmatine and palmatine respectively, J. Sci. Ind. Res., *11B*, 337.

Doskotch, R. W., Malik, M. Y. and Beal, J. L. (1967) ... Identification of dehydrocorydalmine and a new protoberberine alkaloid, J. Org. Chem., *32* (10), 3253.

Johansen, D. A. (1940) ... Plant Microtechnique, Ist Ed., 182, Mc. Graw Hill Book Co. Inc., New York and London.

Kay, L. A. (1938) ... Microscopical studies of Drugs, 1st Ed., 18, Bailliere, Tindall and Cox., London.

Kirtikar, K. R. and Basu, B. D. (1933) ... Indian Medicinal Plants, *I*, 94, L. M. Basu, Allahabad.

Manske, R. H. F. (1967) ... The Alkaloids, Vol. IX, 110, Academic Press, New York.

Manske, R. H. F. (1968) ... The Alkaloids, Vol. X, Academic Press, New York.

Rabinovich, I. M., Kibalchich, P. N., Fadeeva, I. I., Ilinskaya, T. N., Kuzovkov, A. D., Berezhinskaya, V. V., Trutneva, E. A. and Nikitina, S. S. (1966) ... Apteehu Delo, *14*, 19.

Sharma, P. V. (1956) ... Dravya Gun Vigyan, 1st. Ed., II, 474, Choukhamba Vidya Bhawan, Varanasi.

Shchelchkova, I. I., Ilinskaya, T. N., and Kuzovkov, A. D. (1966) ... Khim. Prirodn. Socdin, Akad. Nank, U. S.S.R. *4*, 271.

Wa, T. M., Beal, J. L. and Doskotch, R. W. (1967) ... A study of the quaternary alkaloids of Stephania glabra, Lloydia, *30* (3), 245.

Wallis, T. E. (1953) ... Practical Pharmacognosy, J. and A. Churchill Ltd., London.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

हिन्दी सारांश

राजपाठा (स्टीफेनिया ग्लैबरा मायर्स) पर औषधि प्रकृति विज्ञानीय अध्ययन

संकठा प्रसाद एवं ए० के० वाही
(भेषज विज्ञान विभाग, काशी हिन्दू विश्वविद्यालय, वाराणसी)

प्रस्तावना

राजपाठा एक वृहद् आरोही क्षुप है। यह पौधा उष्ण एवं शीतोष्ण क्षेत्रों में समुद्र तल से लगभग ७००० फुट की ऊंचाई पर पाया जाता है। शिमला से शिक्किम, खासी की छोटी पहाड़ियों, आसाम और तेनासरीम आदि क्षेत्रों में पाया जाता है। इसे सामान्यतः राजपाठा, पुरहा, गिन्दास भी कहते हैं। साइक्लिया पेल्टेता और सीसेम्पेलाश परेरा आदि कोभी इसके स्थान पर ग्रहण करते हैं। आयुर्वेदीय चिकित्सा पद्धति में राजयक्ष्मा, श्वाँस, विसूचिका ज्वर एवं आंत्रगत रोगों में प्रयोग करते हैं। (कीर्तिकर और वसु, १९३३; शर्मा. १९५६) अनेक अनुसंधायकों द्वारा इसमें से १८ सक्रिय तत्व पैलमेटीन, ट्रेट्राहाइड्रो पैलमेटीन, गिन्डरीसीन स्टेफेरीन एवं प्रोनूसिफेरीन, हिन्डेरीन, और साइक्लीनीन, कोलम्बामाइन, जैट्रोराइजिन, मैग्नोफ्लोरीन, डीहाइड्रो-कोरीडालमाइन, स्टेफेरेनाइन, स्टेफरोटीन आदि, तथा अन्य पांच हाइड्रोक्लोराइड बेसेज जिसका कि द्रवणांक २५३ डिग्री सेन्टीग्रेड है प्राप्त किया गया। इसकी तुलना में इसका औषधि प्रकृति विज्ञानीय अध्ययन एक तरह से नगण्य ही रहा है, अतः इस रिक्तता को ध्यान में रख कर किये गये अध्ययन को इस निबन्ध में दिया गया है।

सामग्री एवं विधि

राजपाठा के सूखे पौधे, संरक्षक भेषज-सर्वेक्षण-संस्थान हरिद्वार से प्राप्त किये गये। उनको हस्त एवं माइक्रोटोम से सेक्शन्स काटकर स्टेन कर, माउन्ट कर दिया गया। उसके बाद कोशा घटक, कोशा भित्ति आदि का अध्ययन की (१९३८) तथा जानसन (१९४०) के आधार पर किया गया और उनका परिमाणात्मक परिगण्न वालिश (१९५३) की विधि पर किया गया। चेज और प्राट (१९४९) की विधि के अनुसार उनका प्रदीप्त विश्लेषण भी किया गया।

इसकी ग्रन्थि, तना एवं पत्रक के स्थूलदर्शी अध्ययन से पता चलता है कि इसकी ग्रन्थियाँ अपने आकार प्रकार में काफी भिन्नता रखती हैं। गोली, अर्धगोली-नुकीली, अण्डाकार तथा खुरदुरी होती है। उनमें वातरन्ध्र विद्यमान रहते हैं। उनके ऊपर रेशेदार जड़ों का कुछ निशान भी रहता है। नये कंद श्वेत पीताभ रंग के तथा पुराने काले भूरे-रंग के तथा सूखे होते हैं। तना वर्तुलाकार तथा चिकने-तल वाले होते है। नयी अवस्था में हो तथा परिपक्वावस्था में लम्बी लम्बी धारियां होती हैं तथा उनका रंग हरा भूरा होता है। बाजारों में पाये जाने वाले टुकड़े १.५ सेन्टीमीटर मोटे तथा रज्जुवत एवं रेशेदार लगते हैं। पत्र ४ से १२ सेन्टीमीटर लम्बे तथा ४ से १० सेन्टीमीटर चौड़े पाये जाते हैं। ये सामान्य, घनाकार, कोणावत, अरोमिल, बर्तुलाकार, रज्जूवतजालमय, विकीर्णित केशिकाओं से युक्त होते हैं। इनके सवृन्त पर्णावृन्त ३ से ६ सेन्टी-मीटर लम्बे होते हैं। इनके सूक्ष्मदर्शी अध्ययन तथा प्रदीप्ति विश्लेषण में अनेक महत्वपूर्ण तथ्य निर्दशित किये गये हैं।

विमर्श

राजपाठा की ग्रन्थि, तना तथा पत्र पर किये गये प्रदीप्ति विश्लेषण एवं भेषजगुण विज्ञानीय अध्ययन इसकी वास्तविक पहचान में सहायक घटक सिद्ध होगे।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Jour. Res. Ind. Med. 4, 2, 1970.

BOTANICAL IDENTITY OF ZARNAB (FLACOURTIA JANGOMAS LOUR)

S. H. AFAQ*

(*From the Pharmacognosy Laboratory, Institute of History of Medicine and Medical Research, New Delhi*)

(Received for publication on July 1, 1969)

Introduction

An examination of the market sample showed that different material goes under the name of *Zarnab* (Unani) in Delhi raw drug trades. Hence an investigation was initiated for the exact botanical identity of this material.

As the Delhi practitioner says, and in the literature the botanical name of *Zanrab* is given to be *Flacourtia jangomas* Lour. (Syn. *Flacourtis cataphracta* Roxb.) belonging to the family *Flacourtiaceae* (Kirtikar and Basu, 1933). But the morphological and anatomical study shows that the crude drug *Zanrab* is quite a different one. It is an indigenous drug and it has been used since ancient days as carminative, stomachic and tonic, useful in cough ; the flowers are very much useful in headache when used with *Roghan-e-Banafsha* (*Viola odorata* Linn.) or water.

Materials and Methods

The material was collected from the local market and the morphological and anatomical study was made here ; the hand cut and microtomic transverse sections were prepared for the anatomical study. The method applied for the microtomic sections followed that of Johansen (1940).

OBSERVATION

The material consists of only leaves, and this crude drug was reported to be collected in large quantities from the forest of Aru hills and other parts of the Himalayan range.

MACROSCOPY

The leaves (Fig. 1) are dark green, flattened, linear, acute, narrow and short stalked, the size being 1 to $1\frac{1}{2}$ inch ; the upper surface was shining and the lower pale or rusty red.

Fig. 1—The leaves of *Zarnab*

* Botanist.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

MISCROSCOPY

The anatomical study has been done only from the transverse sections. In the transverse section (Fig. 2), the epidermis shows a single layer of some what rectangular, compact cells, which are heavily cutinized. The stomata on the upper epidermis are totally absent. The epidermis is followed by the longitudinally arranged single or double layered palisade tissue, which have large quantity of chlorophyll.

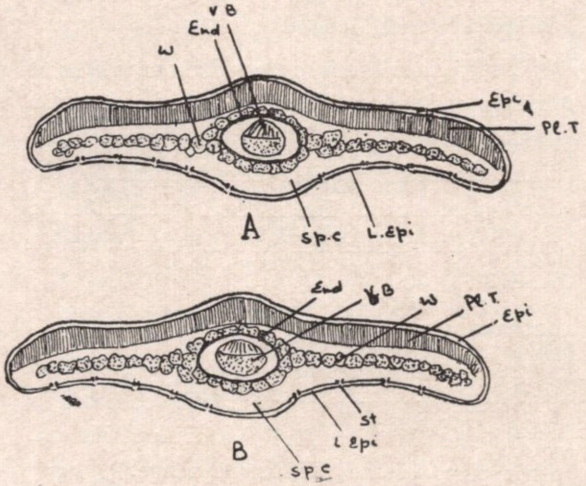


Fig. 2. Diagrammatic representative of leaves
A—*Zarnab*
B—*T. baccata* Linn.

The spongy parenchyma is very clear. In the middle of the leaves and around the vascular bundle closed grained wood of redish colour is present. The lower epidermis is like the upper epidermis but having sunken stomata, tapped by the cell wall of the epidermis. Some grained white material is filled at the mouth of the stomata. Endodermis is denoted by only a single layer of cells with some starch grains. The vascular bundle is collateral and endarch. Xylem parenchyma is less than the phloem parenchyma ; xylem is above and the phloem is below.

Transfusion tissue is present in between the vascular bundles and endodermis. Cell of the transfusion tissue is thick and polygonal. Resin ducts are absent (Fig. 3).

Step in Identification

As many xerophytic characters are present such as sunken stomata and heavily cutinized epidermis, the possibilities are that the leaves may belong to any xerophytic plant. But the transfusion tissue and the endarch and collateral position of the vascular bundle, the presence of the starch grain into the endodermis, the abundance of phloem parenchyma in excess of xylem parenchyma, confirm that the leaves belong to the group *Gymnosperm*. Since *Cycadales*, *Coniferales*, *Ginkgoales*, *Gnetales Ephederales* and *Welwestiales* are the natural orders of the group *Gymnosperm*, the material may fall in any of the above orders.

The distinguishing characters of the leaves of order *Cycadales* are, that, they have compound leaves with mesarch type of vascular bundles associated with resin ducts. The order *Coniferales* have simple, linear, acute, lanceolate or needle type of leaves and endarch position of vascular bundles. The order *Ginkgoales* have simple, fan shaped and bilobed leaves. The order *Ephederales* have scaly leaves ; order *Gnetales* have leaves with leathery texture being pinnatly and reticulately veined ; order *Welwestiales* have wide and parallel veined leaves. On the basis of the above characteristics it is concluded that the material can only belong to the order *Coniferales* (Randle, 1929 ; Heber, 1951 ; Esau, 1953 ; Coulter & Chamberlain, 1955).

The drug was indigenous and hence the material was first compared with the indigenous members of the order *Coniferales*. The *Cupressus*, *Cedrus*, *Pinus*, *Picea*, *Abies*, *Taxus* and

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Juniper are the plants which are recorded to be indigenous to India till now. Out of these plants the material shows the characters of *Taxus*. The leaves of *Cuperessus* are generally very short and scale like ; the leaves of the *Cedrus* are found to be three angled ; *Pinus* are needle like or three angled ; *Picea* are four angled ; the leaves of *junipers* are of herby nature, and are in threes or pairs, spreading, acute and the size is $\frac{1}{4}''$—$\frac{3}{4}''$ straight in *J. communis* and 1/5″ curved in *J. recurva ;* although the leaves of *Abies* are also flattened the lower surface is white in colour ; so it is possible that the material may be the leaves of *Taxus* (Heber, 1951 ; Collett 1921).

The anatomical characters such as the absence of resin ducts, the absence of stomata on the upper epidermis and the presence of the hard closed grained wood of reddish colour support the conclusion that the material are the leaves of *Taxus*.

There are three species of *Taxus*, *T. canadensis* (American Yew), *T. capsidata* (Japanese Yew) and *T. baccata* (European Yew). As the drug is indigenous, the possibility is that this specimen may be the leaves of *T. baccata* Linn. Therefore the herbarium specimen of the leaves of *Taxus baccata* Linn. (Fig. 4 & 5) was compared morphologically and anatomically with the drug leaves and it was found that all the characters were the same and hence it was concluded that the drug *Zarnab* could only be the leaves of *Taxus baccata* Linn. of the family *Taxaceae*.

Discussion

In the Unani literature (Husain 1766 and Khan 1894) it is written that *Zarnab* is known

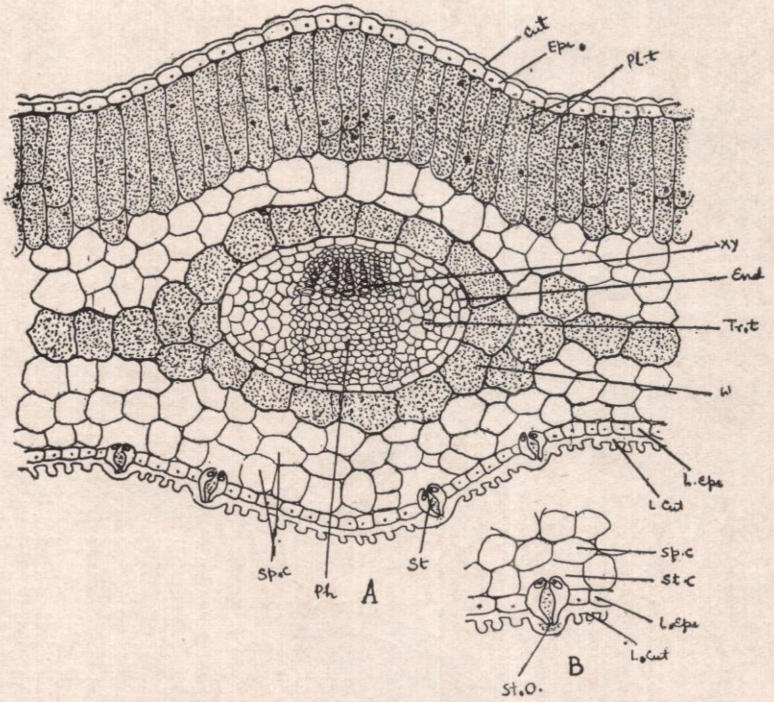


Fig. 3. A—T.S. of a portion of *Zarnab* through the region of midrib.
B—A portion of lower epidermis showing sunken stomata.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Fig. 4—The herbarium specimen of *T. baccata* Linn.

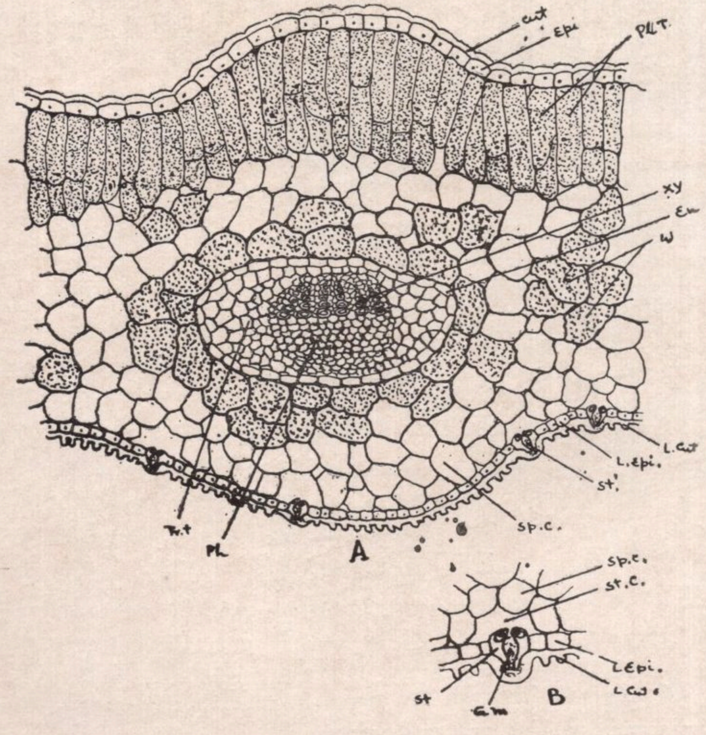


Fig. 5. A—T.S. of a portion of leaf of *T. baccata* Linn. through the region of midrib.

B—A portion of the lower epidermis showing sunken stomata.

ABBREVIATIONS

Cut—cuticle, Epi—Epidermis, Pl. T.—Palisade tissue, End—Endodermis, Tr. t, Transfusion tissue, Sp. C—Spongy paranchyma, W—Wood of reddish colour, Xy—Xylem, Ph—Phloem, L. Cut—Lower cuticle, L. Epi—Lower epidermis, St. stomta, St. c—Stomatal chamber, G.M.—white grained material. V.B.—vascular bundle, St.O.—Stomatal opening.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

as '*Talishpatra*' in Hindi. After this finding the literature was again consulted and it was noted that *Taxus baccata* Linn. is known as '*Talishpatra*' in some parts of India (Chopra and Nayar, 1956). The above point supports the conclusion that the drug *Zaranb* is derived from the *Taxus baccata* Linn.

Conclusion

It is concluded that the crude drug *Zarnab* which is in use in Delhi are the leaves of *Taxus baccata* Linn. of the family *Taxaceae* of the group *Gymnosperm.*

Summary

The leaf drug *Zarnab* which is used in Unani system of medicine as carminative, stomachic, tonic and cure for cough, and further used for the cure of headadhe mixed with *Roghan-e-Banfsha* or water is written under the name of *Flacurtia cataphracta* Roxb. But the material which is known as *Zarnab* in Delhi raw drug trades is some thing else. The work for the botanical identity of this material was conducted here on the basis of morphology and anatomy of leaves and it is concluded that the drug *Zarnab* is the leaves of *Taxus baccata* Linn. which is a Gymnospermic plant

ACKNOWLEDGMENT

The author is very much thankful to Dr. D. P. Tiwari, Govt. College, Jabalpur for his kind guidance and necessary advice, to Hakim Abdul Hamid, President of the Institute, to Dr. A. Jalil, Director, of the Institute and to Dr. M. S. Y. Khan for his keen interest throughout the course of this investigation.

REFERENCES

COLLETT, H. (1921) ... Flora Simlensis. 1st Ed. p. 484-488 Thacker Spink and Company, London.

CHOPRA R. N., NAYAR S. L. AND CHOPRA I. C. (1956) ... Glossary of Indian Medicinal Plants, 1st Ed. p. 240, Council of Scientific and Industrial Research, New Delhi.

COULTER, J. M., CHAMBERLAIN, C. J. (1955) ... Morphology and Gymnosperm. p. 106-111, 189-190, 235-238, 317, 369-371, Central Book Depot, Allahabad.

ESAU, K. (1953) ... Plant Anatomy p. 437-440 John Willy and Sons, New York.

EAMES, A. J. AND MACDANIELS, L. H. (1947) ... An Introduction of Plant Anatomy. 1st Ed. p. 317, McGraw Hill Book Company, New York and London.

HEBER, W. AND YOUNGKEN (1951) ... Pharmaceutical Botany, 1st Ed. p. 461, 479, 481, The Blikistone Company.

HUSAIN, M. (1766) ... Makhzanul-advia, 1st Ed. I, p. 544 (Translation of this book by Qureshi, A.R. published by Sheikh Ghulam Husain & Sons, Lahore consulted).

JOHANSEN, D. A. (1940) ... Plant Microtechnique, p. 126-154, McGraw Hill Book Company, New York and London.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

KIRTIKAR, K. R. & BASU B. D., (1933 ... Indian Medicinal Plant, Ed. I and III, p. 221 2383, Lallit Mohan Basu, Allahabad.

KHAN, M. A. (1894) ... Muheet-e-Azam, 1st Ed. II, Part III, p. 94, Mahtaba Nizami, Kanpur.

RANDLE, A. B. (1929) ... The classification of the flowering plant, 1st Ed. I, p. 63, 74, 119, Cambridge University Press.

हिन्दी सारांश

ज़रनब की वनस्पति विज्ञानीय पहचान

एस० एच० आफ़ाक़

(इन्स्टीच्यूट आफ हिस्ट्री आफ मेडीसिन एण्ड मेडिकल रिसर्च, नयी दिल्ली)

प्रस्तावना

ज़रनब नामक औषधि का प्रयोग यूनानी चिकित्सा पद्धति में बहुत प्राचीन कालसे वातसारी, क्षुधा उद्दीपक, तथा बल्य के रूप में होता आरहा है। कास तथा शिरः शूल में रोगन बनफ़सा (वियोला ओडोरेटा लिन) और जल के साथ उसके पुष्पों का प्रयोग करते हैं। इसका लैटिन नाम 'फ्लेकार्सिया कैटाफैरेक्टा राक्स' बताया जाता है (कीर्तिकर एवं बसु १९३३)। चिकित्सामें प्रयोग के लिए दिल्ली के क्षेत्र में पाया जाने-वाला ज़रनव इससे भिन्न है। इस बात को ध्यान में रखकर इसके औषधि प्रकृति विज्ञानीय अध्ययन का विवरण प्रस्तुत निबंध में दिया जारहा है।

सामग्री एवं विधि

इसके लिए ज़रनब को दिल्ली के स्थानीय औषधि विक्रेताओं से संकलित किया गया। जानसन (१९४०) की विधि के आधार पर सेक्शन्स तैयार कर रंजित किये गये और उनके आकृति विषयक संरचनात्मक अध्ययन किये गये। यह औषधि द्रव्य का मुख्यतया पत्र ही प्रयोग होता है तथा इसे हिमालय तथा अन्य क्षेत्रों से एकत्रित किया जाता है।

विमर्श

पत्तियां गहरी हरी, चौड़ी, लम्बी, कोणात्मक तथा पतली होती हैं। पत्रवृंत छोटे होते हैं। इनकी लम्बाई एक से डेढ़ इंच तथा इसका ऊपरी स्तर चमकदार तथा निचला भाग पीला तथा धूसर होता है। सूक्ष्मदर्शी अध्ययन से पता लगता है कि दिल्ली के बाजारों में ज़रनब के नाम से उपलब्ध वनस्पति टेक्सस बैकेटा लिन नामक जिम्नोस्परमिक (नग्नबीज-व्रक्षक) जाति का है, जिसे वास्तव में भ्रमवश 'फ्लैकर्सिया कैटाफ्रैक्टा राक्स' के स्थान पर ग्रहण करते हैं।

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Research Communication

CLINICAL TRIALS OF OCIMUM SANCTUM LINN. (TULSI) IN PEPTIC ULCER AND HYPER-ACIDITY PATIENTS

[Received for publication on March 26, 1969]

Ocimum sanctum Linn (*Tulsi*), a plant grown commonly throughout India, was tried on patients of peptic ulcer or hyper-acidity at Hamdard Research Clinic and Nursing Home, New Delhi. Powdered leaves of the plant were used in the form of tablets, each weighing 5 g. A maximum dose of 27g/day was used. The only side effect noted was constipation.

Only the patients presenting clinical signs and symptoms along with a definite radiological evidence of peptic ulcer (gastric or duodenal) or hyperacidity (gastric analysis values above 45 ml of N/10 NaOH were considered diagnostic for our series) were selected for the study. They were admitted in research wards and kept under observation for 3 months. Normal food was provided without any restriction. Smoking was curtailed if it was excessive.

145 patients, 65 males and 80 females were selected for study. Ba meal X rays and gastric analysis were repeated every month. Twenty patients discontinued the treatment in the early stage. Among the remaining patients, symptomatic improvement was noticed in 66% of all the cases, though objective improvement in the form of healing of ulcer or diminution in total acidity was demonstrated in only 20% of cases. Complete healing of the ulcer was seen in only 18% of patients. Since this is a preliminary study, no controls were included in it and it is difficult to assess the real merit of *Tulsi*. Further work will follow.

ACKNOWLEDGMENT

Hakim Abdul Hameed Sahab, Mutawalli, Hamdard (Waqf), kindly made available the funds necessary for this project.

A. JALIL

Institute of History of Medicine and Medical Research, Asaf Ali Road, New Delhi-1.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

हिन्दी सारांश

परिणामशूल अथवा अन्नद्रवशूल के रोगियों में तुलसी का नैदानिकीय परीक्षण

तुलसी का पौधा भारत के हर भाग में मिलता है, उसीका प्रयोग हमदर्द नैदानिकी अनुसंधान केन्द्र के माध्यम से अन्नद्रवशूल तथा परिणामशूल के रोगियों में किया गया। इसके लिए पत्र चूर्ण की बनायी गयी (५ ग्राम भार की) टिकिया का प्रयोग किया गया है। प्रतिरोगी के लिए उच्चतम मात्रा २७ ग्राम तक दी गयी, तथा इस औषधि को रोगियों को देने पर अनुषंगी प्रभाव के रूप में 'बिबन्ध' पाया गया। इस परीक्षण के लिए रोगियों का चयन आमाशयद्रव विश्लेषण, क्षःकिरण-परीक्षण, लक्षणों के विवेचन आदि के आधार पर किया गया। रोगियों को अनुसंधानार्थ अतुरालय में रखकर तीन मास तक परीक्षण किया गया। रोगियों को सामान्य आहार दिया गया तथा जिन रोगियों में धूम्रपान का बहुल्य था, उन्हें ऐसा कम करने को कहा गया। १४५ रोगियों में से ६५ पुरुष तथा ८० स्त्रियाँ थीं। इन रोगियों का बैरियम मील, क्षः किरण परीक्षण तथा अन्नद्रव विश्लेषण प्रतिमास किया गया।

इनमें से २० रोगियों ने प्रारम्भिक अवस्था में ही चिकित्सा लेना बन्द कर दिया। शेष रोगियों में से ६६% रोगियों में लाक्षणिक रूप से लाभ पाया गया, जबकि वस्तुपरक सुधार आमाशयिक ब्रणों के भरने के रूप में अथवा पूर्ण अम्लता के ह्रास के रूप में, केवल २०% रोगियों में देखा गया। १८% रोगियों में ब्रण पूर्णरूपेण भरे हुए पाये गये। यही परीक्षण प्रारम्भिक प्रकृति का है, इसमें कन्ट्रोल्स को शामिल नहीं किया गया, अतः तुलसी के वास्तविक गुणों पर कुछ कहना भावी कार्य पर निर्भर करता है।

ए० जलील

इन्स्टीच्यूट आफ़ हिस्ट्री आफ़
मेडिसिन एवं मेडिकल रिसर्च
आसफ अली रोड, नयी दिल्ली-१

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

NEWS-ITEM

POST GRADUATE INSTITUTE OF INDIAN MEDICINE

BANARAS HINDU UNIVERSITY

The Sixth Annual Day and the Sixth Annual Scientific Conference of the Post Graduate Institute of Indian Medicine, Banaras Hindu University was held from 12th to 14th December, 1969. Vaidya Ratna Pt. Shiv Sharma, M.P., Chairman, Scientific Advisory Board in Ayurveda of the Central Council of Research in Indian Medicine and Homeopathy was the Chief Guest on the occasion and Dr. K. L. Shrimali, Vice-Chancellor, Banaras Hindu University presided over the function. At the outset Prof. Priya Vrata Sharma, Director of the Institute welcomed the guests and presented the Annual Report of the Institute highlighting the activities of the departments in teaching as well as different fields of Research; literary, fundamental, clinical and drug research. Pt. Shiv Sharma in his address emphasised on the potentialities of Ayurveda having a rich tradition particularly in the present age when the metabolic and degenerative disorders are coming up with prevalence. Ayurveda is not only a vast treasure of drugs but also can contribute in the field of concepts as well. He appreciated the work done by the Institute and hoped that the work would be enhanced further to develop the glory of Ayurveda. Dr. Shrimali in his presidential address remarked that the Ayurvedic scholars should work with self-confidence having strong roots in the tradition and they should also keep their minds open to take advantage of the recent scientific advances. Dr. J. Nagchaudhury, Dean of the Faculty of Medical Sciences proposed the vote of thanks.

The Scientific Conference was divided into seven sessions, out of them three being special sessions on Cardiovascular diseases, Formation of urine and urinary disorders and History of Indian Medicine. The Conference was attended by the scientists, Ayurvedic scholars and research workers from different parts of the country who took active parts in the deliberations. Forty two papers in all were presented.

Two Memorial Lectures—one in the memory of Late Pt. Satyanarayan Shastri and other in the memory of Late Pt. Rajeshwar Dutt Shastri, Ex-Principals of the Ayurvedic College, Banaras Hindu University were organised. The first lecture was delivered by Pt. Haridutt Shastri, Director, M. K. R. Ayurvedic Hospital and Research Centre, Delhi on the topic of Dhatwagni. The other lecture was delivered by Pt. Ram Raksha Pathak, formerly Director, Bandarnaike Memorial Ayurvedic Researh Institute, Colombo, Ceylone on the Principles of Ayurvedic Treatment.

On this occasion a felicitation address was presented to Dr. C. Dwarakanath, formerly Adviser, Indigenous Systems of Medicine, Ministry of Health for his valuable contributions in the field of Ayurveda. A book entitled 'Advances in Indian Medicine' containing articles mostly from the teachers of the Institute and published by the University was also dedicated to him.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Government Notification

CIRCULAR

Ref. No. F. 14-3/69-CCRIM & H

CENTRAL COUNCIL FOR RESEARCH IN INDIAN MEDICINE AND HOMEOPATHY

E-25, Defence Colony, New Delhi-3. October 10, 1969.

Subject :—Central Council for Research in Indian Medicine and Homeopathy.

The Central Council for Research in Indian Medicine and Homeopathy set up under the Union Ministry of Health, Family Planning, W.H. & U. D., *vide* their notification No. F. 1-3/, dated 22-5-69, has started functioning at the following premises :

E-25, Defence Colony,
New Delhi-3.

All communications may be addressed to the Director, Central Council for Research in Indian Medicine and Homeopathy at the above address.

Sd/- P. N. V. KURUP
Director

Copy Forwarded to

1. Private Secretary to Minister for Health, F.P., W.H. & U. D.
2. Private Secretary to Minister for State (W. H. & U. D.).
3. Private Secretary to Ministers for State (F.P.), Ministry of Health & F.P.
4. P.S. to Secretary.
5. P.S. to Additional Secretary.
6. P.A. to J.S. (U).
7. P.A. to J.S. (L.).
8. All members of the Governing Body.
9. Post Master, New Delhi/Post Master, Lodi Colony, New Delhi.
10. C.H.E.B., Kotla Road, New Delhi.
11. Indian Council for medical Research.
12. Central Journal of Research in Indian Medicine, C/o Post Graduate Institute in Indian Medicine, Banaras Hindu University, Varanasi-5.
13. Editor, Ayurved Lok, Gujarat Ayurveda University, Jamnagar.
14. The Delhi Telephones.
15. Press Information Bureau.
16. D.G.H.S., New Delhi. (10 spare copies).
17. Department of Health, Ministry of Health, F.P., W.H. & U.D., Nirman Bhavan, New Delhi-11, along with 50 spare copies for circulation amongst all officers and sections concerned. The council may be included in the general list for forwarding of all Government of India circulars and orders.
18. Department of F.P., Nirman Bhavan, New Delhi. (with 10 spare copies).

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

CUMULATIVE INDEX

AUTHOR INDEX*

Vol. : Page

AFAQ, S. H.: Botanical identity of Zarnab (Flacourtia jangomas Lour). 4 : 232
ANSARI, M. S. *See* PRASAD, S. ANSARI, M. S. AND PRSAD, S.: Pharmacognostical studies on roots of Tribulus terrestris Linn. (Gokhru mool). 4 : 193
ARORA, R. B. *See* GARG, B. D.
ATAL, C. K. *See* SHARMA, B. M.
BASU, K. *See* BHATTACHARYA, S. K.
BASU, N. *See* RAMASWAMY, A. S.
BHATTACHARYA, S. K. *et al.*: Pharmacological studies on the roots of Abroma augusta Linn. (Ulatkambal). 4 : 176
BHATTACHARYA, S. K. *et al.*: Pharmacological investigation on the total tertiary alkaloids of Fumaria parviflora Lam (Parpataka). 4 : 152
CHAKRABORTTY, T. *et al.*: Aphanamixinin, a new Seco-Ring-B-Tetranortriterpenoid of Aphanamixis polystachya Wall and Parker (*Rohitaka*) 4 : 121
CHANDRA, V.: Epidermal studies of Solanum plants. 4 : 63
CHANDRASEKHARAN, S. *See* CHAKRABORTTY, T.
CHATTERJI, S. C. *See* PRASAD, G. C.
CHATURVEDI, C. *See* TEWARI, P. V. (MISS).
CHOUDHURY, R. C. AND DESHPANDE, P. J.: Concept of corneal opacity in Ayurveda and its management with indigenous drugs. 4 : 108
DAS GUPTA, B. *See* BHATTACHARYA, S. K.
DAS P. K. *See* SATYAVATI, G. V.
DAS, P. K. *See* BHATTACHARYA, S. K.
DESHPANDE, P. J. *See* CHOUDHURY, R. C.
DIXIT, B. S. AND (MISS) TEWARI, P. V. Concept of tubercular lymphadenitis in Indian medicine and its treatment with indigenous drugs. 4 : 113
DIXIT, S. N. *See* TEWARI, P. V. (MISS).
DUBEY, G. P. *See* SINGH, R. H.
GARG, B. D. *et al.*: Phytochemical and phamacologial investigations of Anchusa strigosa (*Gaozban*), an Indian medicinal plant. 4 : 185
GUPTA, S. K. *See* GARG, B. D.
ISSAR, R. K. *See* UNIYAL, M. R.
KOHLI, R. P. *et al.*: A study of cardiotonic activity of Nerium indicum (*Rakta Kaner*) on heart-lung preparation of dog. 4 : 54
KRISHNASWAMY, N. R. *See* GARG, B. D.
KULSHRESTHA, V. K. *See* KOHLI, R. P.
KUNDU, A. B. *See* CHAKRABORTTY, T.
LAL, R. *See* BHATTACHARYA, S. K.
LILLYKUTTY, L. AND SANTHAKUMARI, G.: Antimicrobial activities of Cassia fistula Linn. (*Aragvadha*) 4 : 25
PERIYASAMY, S. M. *See* RAMASWAMY, A. S.

*By V. N. Pandey, Editorial Secretary, Journal of Research in Indian Medicine, Post Graduate Institute of Indian Medicine, Banaras Hindu University.

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Vol. : Page

PRABHU, S. See SHARMA, V. N.

PRAKASH, A. AND PRASAD, S.: Pharmacognostical studies on the bark of Oroxylum indicum Vent (*Shyonaka*). 4 : 73

PRAKASH, A. AND PRASAD, S.: Pharmacognostical studies on the bark of Aegle marmelos Correa (*Bilva*). 4 : 97

PRASAD, D. N. See SATYAVATI, G. V.

PRASAD, G. C. *et al.*: Effect of phytogenic steriod of Cissus quadrangularis (Hadjora) on endocrine glands after fracture. 4 : 132

PRASAD, S. *see* ANSARI. M. S.

PRASAD, S. *see* PRAKASH, A.

PRASAD. S. *et al.*: Pharmacognostic study of the leaves of Pluchea lanceolata C. B. Clarke and Olive (*Rasna*). 4 : 203

PRASAD, S. AND WAHI, A. K.: Pharmacognostical studies on Stephania glabra Miers (*Rajpatha*). 4 : 221

PRASAD, S. AND WAHI, A. K.: Pharmacognostical study of leaf of Vitex negundo Linn. (*Nirgundi*). 4 : 208

RAGHUNATHAN, K. AND SHARMA, P. V. Effect of Tinospora cordifolia Miers (*Guduchi*) on adrenaline induced hyperglycaemia. 4 : 59

RAMASWAMY, A. S. *et al.*: Pharmacological studies on Centella asiatica Linn. (*Brahma Manduki*) (N. O. Umbelliferae). 4 : 60

ROMA MITRA (MISS) *see* PRASAD, S.

SANTHAKUMARI, G. *see* LILLYKUTTY, L.

SANYAL, A.K. *see* BHATTACHARYA, S.K.

SATYAVATI, G. V. *et al.*: Investigations into the Uterine activity of Saraca indica Linn. (*Ashok*). 4 : 37

SEN, S. P. *see* SATYAVATI, G. V.

SHAH, C. S. *see* PRASAD, S.

SHAH, N. S. *see* PRASAD, S.

SHARMA, B. M. *et al.*: Pharmacognosy of root of Cherophyllum villosum Wall: an adulterant of Aconitum heterophyllum Wall (*Atis*). 4 : 68

SHARMA, B. M. *et al.*: Pharmacognostic study of fruits of Mimusops elengi L. (*Bakul*). 4 : 214

SHARMA, P. V. *see* RAGHUNATHAN, K.

SHARMA, V.N. *et al.*: Anti-inflammatory activity of Ricinus communis Linn. (*Eranda*). 4 : 47

SINGH. P. *see* SHARMA, B. M.

SINGH, N. *see* KOHLI, R. P.

SINGH, R. H. AND DUBEY, G. P.: A comprehensive study on psycho-somatic constitution (*Prakriti*) in relation to different types of arthritis. 4 : 1

SINGH, V. *see* SHARMA, V. N.

SRIVASTAVA, R.K. *see* KOHLI, R. P.

TEWARI, P. V. (MISS) *see* DIXIT, B. S.

TEWARI, P. V. (MISS) *et al.* Antifertility effect of betal leaf stalk (*Tambul Patrabrint*). 4 : 143

UDUPA, K. N. *see* PRASAD, G. C.

UNIYAL, M. R. AND ISSAR, R. K. Commercially and traditionally important medicinal plants in Mandakini valley of Uttar Khand, Himalayas, 4 : 83

WAHI, A. K. *see* PRASAD, S.

ZALIL, A. Clinical Trials of Ocimum sanctum linn. (*Tulsi*) in peptic ulcer and hyperacidity. 4 : 238

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

TITLE-INDEX*

	Vol. : Page
Abroma augusta Linn. (*Roots*) Pharmacological Studies on—	4 : 176
Aconitum heterophyllum Wall (*Atis*) an adulterant of—	4 : 68
Adrenalin induced hyperglycaemia effect of *Guduchi* on—	4 : 59
Aegle marmelos Correa (*Bilva*) studies on—	4 : 97
Alkaloides, (Total tertiary) Pharmacological investigation on—	4 : 152
Anchusa strigosa, phytochemical and pharmacological investigation of—	4 : 185
Anti-fertility effect of betal leaf stalk (*Tambul Patrabrinta*)	4 : 143
Anti-inflammatory activity of Ricinus communis Linn. (*Eranda*).	4 : 47
Antimicrobial activities of Cassia fistula Linn. (*Aragvadha*).	4 : 25
Aphanamixinin, a new seco-Ring-B-Tetranortriterpenoid of Aphanamixis polystachya Wall and Parker (*Rohitaka*).	4 : 121
Aphanamixis polystachya Wall and Parker (*Rohitaka*) for studing Aphanamixinin—a new Seco-Ring-Tetranortriterpenoid.	4 : 121
Aragvadha, Antimicrobial activities of—.	4 : 25
Arthritis, *Prakriti* in relation to different types—	4 : 1
Ayurveda, concept of corneal opacity and its management with indigenous drugs in—	4 : 108
Ashoka (Saraca indica Linn.) investigations on—	4 : 37
Ba*kul* (fruits) pharmacognostic study on—	4 : 214
Betal leaf stalk, anti-fertility effect of—	4 : 143
Bilva, (Aegle marmelos Correa) Pharmacognostical studies on the bark of—	4 : 97
Botanical identity of *Zarnab* (Flacourtia Jangomas Lour).	4 : 232
Brahma Manduki, Pharmacological studies on—	4 : 160
Cardiotonic activity of Nerium Indicum (*Rakta Kaner*), study on—.	4 : 54
Cassia fistula Linn. (*Aragvadha*) Antimicrobial activities of—	4 : 25
Centella asiatica Linn. pharmacological studies on.	4 : 160
Cherophyllum villosum wall : (*root*) Pharmacognosy of—	4 : 68
Cissus quadrangularis, effect of its phytogenic steroid on endocrine glands.	4 : 132
Commercially and traditionally important medicinal plants in Mandakini Valley of Uttara Khand, Himalayas.	4 : 83
Comprehensive study on Psychosomatic constitution (*Prakriti*) in relation to different types of arthritis.	4 : 1
Concept of corneal opacity in Ayurveda and its management wiht indigenous drugs.	4 : 108
Concept of tubercular lymphadenitis in Indian medicine and its treatment with indigenous drugs.	4 : 113
Corneal opacity, its management with indigenous drugs.	4 : 108
Editorials....	
Discovery versus development in Indian Medicine.	4 : i--ii
Medical Ethics in Ancient India.	4 : i--ii
Effect of Phytogenic steriod of Cissus quadrangularis (*Hadjora*) on endocrine glands after fracture.	4 : 132
Effect of Tinospora cordifolia Miers (*Guduchi*) on adrenaline induced hyperglycaemia.	4 : 59

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Vol. : Page

Endocrine glands, effect of Cissus quadrangularis on— 4 : 132
Epidermal studies of solanum plants. 4 : 63
Erand, studies on— 4 : 47
Flacourtia jangomas lour, botanical identity of— 4 : 232
Fumaria parviflora lam (Tertiary alkaloids) pharmacological investigation— 4 : 152
Gaozban, a phytochemical and pharmacological investigations of— 4 : 165
Gokhru mool, pharmacognostical studies on— 4 : 193
Government notifications.
Central Council for Reserch in Indian Medicine and Homeopathy (Cr. F. 14-3-69-CCRI-M & H.) 4 : 241
Central Govt. Drug Control Association Gujarat State 4 : 131
Guduchi, effect of— 4 : 59
Hadjora, effect on endocrine glands. 4 : 132
Heart-lung preparation of dog, a study of— 4 : 54
Indian medicinal plant, *Gaozban*, investigations on— 4 : 185
Indigenous drugs, in the management of corneal opacity. 4 : 108
Indigenous drugs in the treatment of tubercular lymphadenitis. 4 : 113
Investigations into the uterine activity of Saraca indica Linn. (*Ashoka*). 4 : 37
Letter to the Editor.
Calcium group of Bhasmas 4 : 123
Mandakini Valley of Uttarakhand, Himalayas, study on medicinal plants of— 4 : 83
Medicinal plants of Himalayas study on— 4 : 83
Mimusops elengi L, (*fruits*), pharmacognostic studies on— 4 : 124
Nerium indicum, (*Rakta Kaner*) Study on— 4 : 54

Vol. : Page

Nirgundi, (leaf) pharmacognostical study on— 4 : 214
Obituary (Shastri, S. N.). 4 : 132
Oroxylum indicum vent (*shyonaka*) studies on the bark of—. 4 : 73
Parpataka, (total tertiaryalkaloids) pharmacological investigation on— 4 : 152
Pharmacognostic study of fruits of Mimusops elengi L. (*Bakul*). 4 : 214
Pharmacognostic study of the leaves of Pluchea lanceolata C. B. Clarke and Olive (*Rasna*). 4 : 203
Pharmacognostical study of leaf of Vitex negundo Linn. (*Nirgundi*). 4 : 208
Pharmacognostical studies on roots of Tribulus terrestris Linn. (*Gokhru mool*). 4 : 193
Pharmacognostical studies on Stephania glabra Miers (*Rajpatha*). 4 : 221
Pharmacognostical studies on the barks of Aegle marmelos Correa (*Bilva*) 4 : 97
Pharmacognostical studides on the bark of Oroxylum indicum Vent (*Shyonaka*). 4 : 73
Pharmacognosy of root of Cherophyllum villosum Wall : An adulterant of Aconitum heterophyllum Wall (*Atis*). 4 : 68
Pharmacological investigation on the total tartiary alkaloids of Fumaria parviflora Lam (*Parpataka*). 4 : 152
Pharmacological studies on the roots of Abroma augusta Linn. (Ulatkambal). 4 : 176
Pharmacological studies on Centella asiatica Linn. (*Brahma Manduki*) (N. O. Umbelliferae). 4 : 160
Phytochemical and pharmacological investigations of Anchusa strigosa (*Gaozban*) : An Indian medicinal plant. 4 : 185

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

	Vol. : Page
Phytogenic steroid, effect of—	4 : 132
Pluchea Lancenolata C. B. Clarke and Olive, (*leaf*) pharmacognostic study of—	4 : 203
Prakriti, study on—	4 : 1
R*ajpatha*, pharmacgonostical studies on—	4 : 221
Rakta kaner (Nerium indicum) study on—	4 : 54
Rasna, (*leaves*) pharmacognostic study of—	4 : 203
Ricinus communis Linn. (*Erand*) for anti-inflammatory studies on—	4 : 47
Rohitaka, for Aphanamixinin a new seco-Ring-B-Tetra-Nortriterpenoid studies on—	4 : 121
Saraca indica Linn. Uterine activity of—	4 : 37
Shyonak (Oroxylum indicum Vent) pharmacognostical studies on—	4 : 73
Short Research Communication—Aphanamixinin, a New Seco-Ring-B-Tetranortriterpenoid of Aphanamixin polystachya Wall and Parker.	4 : 121
Clinical Trials of Ocimum sanctum Linn. (Tulsi) in peptic ulcer and Hyper acidity.	4 : 238
Solanum plants, epidermal studies of—	4 : 63
Stephania glabra miers, pharmacognostical studies on—	4 : 221
Study of cardiotonic activity of Nerium indicum (*Rakta Kaner*) on heart-lung preparation of dog.	4 : 54
Study on psychosomatic constitution (*Prakriti*) in relation to different types of arthritis.	
T*ambul Patrabrinta* antifertility effect of—	4 : 143
Tinospora cordifolia Miers (*Guduchi*) effect of—	4 : 59
Tribulus terrestris linn. (*Roots*) Pharmacognostical studies on—.	4 : 193
Tubercular lymphadenitis and its treatment with indigenous drugs.	4 : 113
U*latkambal* (*roots*) pharmacological studies on—	4 : 176
Vitex negundo Linn. (Leaf) pharmacognostical study on—	4 : 208
Z*arnab*, Botanical Identity of—	4 : 232

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE

Journal of Research in
INDIAN MEDICINE

Vol. IV No. 2, 1970.

CONTENTS

PAGE

Editorial .. .. i-iv

PRASAD, G. C., CHATTERJI, S. C. and UDUPA, K. N. Effect of phytogenic steriod of Cissus quadrangularis (*Hadjora*) on endocrine glands after fracture (*with 8 figures in text*). 132

TEWARI, P. V., CHATURVEDI, C. and DIXIT, S. N. Anti-fertility effect of betal leaf stalk (*Tambul Patrabrint*). (*with 7 figures in text*). 143

BHATTACHARYA, S. K., LAL, R., SANYAL, A. K., DAS GUPTA, B. and DAS, P. K. Pharmacological investigation on the total tertiary alkaloids of Fumaria parviflora Lam (*Parpataka*). (*with 5 figures in text*). 152

RAMASWAMY, A. S., PERIYASAMY, S. M. and BASU, N. Pharmacological studies on Centella asiatica Linn. (*Brahma Manduki*) (N.O. Umbelliferae). (*with 13 figures in text*). 160

BHATTACHARYA, S. K., LAL, R., BASU, K. and DAS, P. K. Pharmacol gical studies on the roots of Abroma augusta Linn. (*Ulatkambal*) (*with 5 figures in text*). .. 176

GARG, B. D., GUPTA, S. K., KRISHNASWAMY, N. R. and ARORA, R. B. Phytochemical and pharmacological investigations of Anchusa strigosa (*Gaozban*): An Indian Medicinal plant. (*with 2 figures in text*). 185

ANSARI, M. S., and PRASAD, S. Pharmacognostical studies on roots of Tribulus terrestris Linn. (*Gokhru Mool*) (*with 3 figures in text*). 193

PRASAD, S., SHAH, C. S., SHAH, N. S., ANSARI, M. S. and (MISS) MITRA, R. Pharmacognostic study of the leaves of Pluchea lanceolata C. B. Clarke and Olive. (*Rasna*) (*With 1 figure in text*). 203

PRASAD, S. and WAHI, A. K. Pharmacognostical study of leaf of Vitex negundo Linn. (*Nirgundi*) (*with 2 figures in text*). 208

SHARMA, B. M., SINGH, P. and ATAL, C. K. Pharmacognostic study of fruits of Mimusops elengi L. (*Bakul*). (*with 3 figures in text*). 214

PRASAD, S. and WAHI, A. K. Pharmacognostical studies on Stephania glabra Miers. (*Rajpatha*). (*with 5 figures in text*). 221

AFAQ, S. H. Botanical identity of Zarnab (Flacourtia jangomas Lour). (*with 5 figures in text*). 232

SHORT RESEARCH COMMUNICATION .. ..

ZALIL, A. Clinical Trials of Ocimum sanctum (*Tulsi*) in peptic ulcer and hyperacidity patients 238

NEWS ITEM 240

GOVERNMENT NOTIFICATION 241

CUMULATIVE INDEX 242

AMUDHAKALASAM SIDDHA LITERARY RESEARCH CENTRE